Requirements for Public Works.

18. For ordinary public works, timber ranging from 4 to 6 feet in girth and up to 27 feet in length is in demand. Timber of larger size is rarely required

At present the following lines of railway are accessible from the forests of the Central Provinces :—

		Miles.
Broad-gauge lines—Nagpur to Bhusawal	...	244
Bhusawal to Allahabad ...	...	568
Wardha to Warora	...	45
	Total ...	857
Narrow-gauge lines—Nagpur to Nandgaon	....	146
Khandwa to Mhow	...	73
	Total ...	219

Assuming the average life of a sleeper to be 12 years, the present annual demand of timber for sleepers for these lines would be as follows :—

	Cubic feet.
Broad-gauge lines	425,000
Narrow do.	61,000
Total ...	486,000

or, in round numbers, 500,000 cubic feet of timber in the shape of sleepers, which corresponds to about 750,000 cubic feet in the log. The construction of several additional lines is now under consideration, and it may safely be assumed that some years hence the annual demand will have risen to 1½ million cubic feet of timber in the log.

The woods in demand for ordinary public works are, at present, teak, sal, and, to a less extent, bija and saj. For railway sleepers teak and sal are the favourite woods; next comes bija; but saj and rohan have also been used, and they have answered well. It is probable that several other kinds will in course of time be used. The quantity of timber supplied by the Forest Department for Public Works, including Railways, amounted during the last three years to 106,000 cubic feet per annum, which is of course only a fraction of the total requirements. There is no reason why in course of time the forests should not furnish the total quantity of timber required.

Requirements for Industries.

19. The local industries consuming forest produce are at present very limited; still a good deal of wood is consumed in the manufacture of iron, by blacksmiths, in the manufacture of catechu, and in the working of cotton mills and of the Warora coal mines. The total present requirements for these purposes cannot be estimated.

The Government of India has of late considered the feasibility of establishing large iron works in Chanda, and at Barwai near the northern boundary of Nimar, and if these projects should be taken up, which is, owing to the superior quality of the iron ore, not unlikely, the consumption of some 50,000 tons of charcoal, corresponding to about 6 million maunds of firewood, may be anticipated.

CHAPTER II.—AREA AND BOUNDARIES.

1.—Area of Reserved Forests.

20. When the Indian Forest Act of 1878 was passed, the area of Government forests in the Central Provinces stood as follows :—

	Square miles.
Reserved forests, under Act VII of 1865	2,549
Unreserved forests	16,953
Total ...	19,502

The question then arose what steps should be taken to bring the forests under the provisions of the new Act. Taking into consideration the fact that an area of some 35,000 square miles of forest lands had been made over to Malguzars at the time of settlement, and that the waste areas remaining at the disposal of Government were free of rights, it was decided to declare all the lands of the latter class *reserved forests* under Chapter II of the Act. In this manner an area of 19,383 square miles was put on a satisfactory legal footing Subsequently some small additions were made, which have brought the area up to 19,430 square miles. It was, however, found that some limited areas had been omitted unintentionally, and a few further estates have since reverted to Government, so that there is now an area of 289 square miles of unreserved forests. This brings the total area of Government forests up to 19,719 square miles.

2.—Management of Reserves.

21. The reservation of the above-mentioned areas was not accompanied by any immediate change in their management. The forests which had been reserves under Act VII of 1865 were, under the new Act, styled *first-class reserves*, and the remainder *second-class reserves*, and each of the two classes continued to be managed as before. The chief objects thus realized are that no part of the area can be alienated without the previous sanction of Government, and that no rights can accrue in any of the forests.

22. The first-class reserves are managed by the Forest Department, with the view of improving their productiveness as forest estates. They are strictly protected against damage, and more than one-half of the area is also under special fire protection. Cuttings are, however, permitted in certain parts for the supply of the people and for public works.

The management of the second-class reserves is in the hands of the Deputy Commissioners, assisted by a staff of Forest Officers. The protective measures so far introduced into them are of a very simple nature (prohibition against cutting a few kinds of trees), and the chief objects aimed at in the management of this area are to supply the requirements of the people of the country with as few restrictions as possible, and to raise a revenue.

It has, however, been recognized that the present state of affairs is in want of improvement. The Government of India has on several occasions urged the transfer of further areas from the second to the first-class reserves, especially in the vicinity of large towns and other centres of consumption; and the Chief Commissioner, in paragraph 12 of his review of the Forest Administration Report for 1881-82, considers this a matter the importance of which to the future interests of the country cannot easily be overrated. Under these circumstances, it will be useful to discuss the subject further here.

23. The areas stood as follow on the 1st April 1882 :—

	Square miles.
First-class Reserves	2,588
Second ditto	16,842
Total ...	19,430

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The question arises—how far should the transfer of areas from one class to the other be extended? To give a final reply to this question is not easy at present. In the first place, our knowledge of the actual requirement per head of population is as yet deficient, and, secondly, the population of the province is rapidly increasing.

24. In Appendix A some information is given regarding the area and population of the several districts, as well as the distribution of the cultivated and waste lands.

The population stood as follows at the time of the last census:—

British Territory	9,838,791
Feudatory States	1,709,720
Total ...	11,548,511

It is understood that the population, in British territory at any rate, has increased about 25 per cent. in nine years, so that its doubling during the next 40 or 50 years is by no means beyond the limits of possibility. As regards the distribution of the people, it should be noted that, though the density per square mile ranges from 60 to 184 according to districts, it does not differ much on the whole if looked at according to divisions, as will be seen from the following data:—

	Inhabitants per square mile.
Nagpur Division	115
Jubbulpore do.	118
Nerbudda do.	101
Chhattisgarh do.	129
Average ...	117

The Nagpur and Jubbulpore Divisions show almost exactly the average density; Nerbudda shows a somewhat less, and Chhattisgarh a somewhat higher, density than the average.

25. Regarding the distribution of areas, the following extract from Appendix A will be found instructive:—

			Square miles.
Assessed cultivated area			22,095
Area of Private Forests ...	Culturable ...	18,455	34,937
	Unculturable ...	16,482	
Area of Government Forests...	First-class Reserves ...	2,588	19,719
	Second ditto ...	16,842	
	Unreserved ...	289	
Total area of Forests ...			54,656

It will be noticed that 10 million people, in round numbers, who cultivate 22,095 square miles, have a forest area of 54,656 square miles for the supply of their requirements, of which 34,937 square miles are private forests attached to the several Malguzari estates. At first sight it would appear that the area of private forests is more than sufficient to supply the present population, and that the Government forests need not be resorted to at all; but in reality matters are different. During the year 1881-82, for instance, the receipts on account of forest produce removed from the Government forests by purchasers amounted to Rs. 8,31,748, and, considering the comparatively low rates at which forest produce is sold, this sum represents the removal of very large quantities. It follows that for certain reasons the people cannot supply themselves from the private forests.

26. The chief reasons given are—

(1) The Government forests contain a better choice of material.

(2) The Malguzars, though bound under the terms of the settlement to permit their ryots the free use of the forests on their estates, put difficulties in the way of the people, with the view of selling the forest produce, for their own benefit, to outsiders.

(3) The distribution of the Malguzari forests is very uneven; some estates have much more forest than is wanted for their own requirements, while others have little or no forest.

(4) The Government forests are in some cases more conveniently situated than the Malguzari forests.

(5) A good deal of forest produce is exported to adjoining provinces.

The first reason may be correct as far as timber and bamboos are concerned, but it would only in exceptional cases hold good as regards firewood, grass, &c. Referring to the second reason, it seems established that the Malguzars in some cases do prevent the people from using the forests on their estates free of charge; but, unless they sell forest produce at lower rates than those charged in the Government forests, they are not likely to dispose of much material; and if they were to adopt such lower rates, the people would buy from them in preference to going to the Government forests. The third, fourth, and fifth reasons explain no doubt, to a great extent, why the Government forests are resorted to. Many of the estates in the plains have no forests, and they must obtain their material either from the Government forests, or from the Malguzari forests outside their own estates, according as the one or other are more conveniently situated, taking into consideration the rates demanded in each case. Considerable quantities of produce are also exported to Berar and elsewhere.

27. On the whole, the fact exists that the private forests, under their present management, cannot supply the requirements of the people who depend on the forests of the Central Provinces. This state of affairs will, however, become more pronounced in the same degree as the population increases. Such an increase will act two-fold:—in the first place, it will increase the total quantity of forest produce required, and, secondly, it will, by bringing additional land under the plough, reduce the forest-producing area. The private estates are estimated to contain a culturable waste area of 18,455 square miles. Assuming that this land is gradually brought under the plough, the areas would stand as follow:—

			Square miles.
Cultivated area		...	40,550
Private forests	... 16,482		
Government ditto	... 19,719		
Total Forest area		...	36,201

It has been shown above that, with 22,095 square miles under cultivation, 34,937 square miles of private forests are not able to supply the people with the necessary forest produce. It follows that with 40,550 square miles under cultivation, and a corresponding increase of population, the remaining 16,482 square miles of unculturable waste in the hands of private parties would be altogether unable to supply the material required. The necessary consequence is that the demands on the Government forests will rise to a multiple of what they are now. Under these circumstances, it is the duty of Government to husband existing resources, and to bring under systematic management as large a proportion as possible of the 19,719 square miles of Government forests.

28. This object can be attained in two different ways :—

(1) by increasing considerably the area of the first-class reserves, or

(2) by removing all distinction between first and second-class reserves, and by closing a certain proportion of the area in rotation.

In order to decide which of these two systems is best adapted to the province, it will be useful to glance at the distribution of the forests. In doing so, only the Government forests and the unculturable waste in private estates should be considered, as the culturable waste outside the Government forests may be assumed to come under the plough in the course of time. The Government forests are very unevenly distributed; while their extent in the highly cultivated district of Wardha amounts to only 8 per cent. of the total area, they cover as much as 54 per cent. in Nimar. Even looking at the areas by civil divisions, considerable differences present themselves :—

Nagpur Division	24	per cent.
Jubbulpore do.	29	„
Nerbudda do.	33	„
Chhattisgarh do.	11	„
Average ...	23	„

The unculturable private waste shows similar fluctuations; thus in Nimar it covers 7 per cent., while in Bilaspur it represents 45 per cent., of the total area of the district. Fortunately, however, these inequalities compensate each other to some extent, the lowest percentage of the two classes of forest combined of any district (Wardha) being 21 per cent., and the highest (Nimar) being 61 per cent. If the matter is looked at by divisions, all inequalities disappear, as the following extract from Appendix A shows :—

Division.	Percentage of forests to total area of division.		
	Government forests.	Unculturable waste in private estates.	Total.
Nagpur	24	16	40
Jubbulpore	29	15	44
Nerbudda	33	11	44
Chhattisgarh	11	32	43
Average ...	23	20	43

It should not of course be overlooked that considerable areas are in remote localities, where they are at present of little use; but the extension of communications is making rapid strides in advance, and a locality which now appears inaccessible may become well connected with the more populated parts of the country after the lapse of a comparatively limited number of years.

29. Returning to the data given in the above table, it should be remembered that unculturable waste in private estates must always remain either forest or grazing land, and any disturbance of the even distribution of the total areas of forest lands can only be brought about by a reduction in the area of the Government forests. Such a result is on the whole more likely to be effected by following the first of the two systems mentioned in the beginning of the previous paragraph, than by adopting the second.

The transfer of additional areas from the second to the first-class reserves is likely to be followed by an increased demand on the areas remaining second-class reserves, and they would no doubt, after the lapse of a limited number of years, be ruined as forests. Having once been cleared, the transition to cultivated land is easy wherever the soil is fit for it, and in many cases such a result is sure to follow. As a matter of fact, there is already a good deal of cultivation in the second-class reserves; and although some areas must ultimately be

given up, it seems of the utmost importance that this step should be taken sparingly. There are still 18,455 square miles of culturable waste outside the Government forests, and it is much the best policy to encourage the extension of cultivation on these areas, rather than inside the Government forest estates. Moreover, if cultivation was permitted within forest limits on a large scale, it is not impossible that the Malguzars would have reason to complain of Government preventing people from settling on their estates, or even of inducing people to leave their estates with the object of settling on Government forest land.

30. On the whole, therefore, it appears that the better policy will be to treat all reserves alike, but to permit the Forest Department to declare a maximum of, say, one-half the area "closed blocks," and to treat these in the manner hitherto applied to the first-class reserves. When these have been fully stocked by means of protection against fire, and by sowing and planting, they will gradually be opened to cutting, while in the same degree blocks hitherto open will be closed for improvement. In this manner a rotation will be established.

There will, however, be a limited area in which special restrictions must always be enforced. Such areas are, for instance, the Ahiri and Banjar Reserves, which will be specially set aside for the production of large timber, chiefly for public works. These forests will yield considerable quantities of firewood, grass, &c., for the people; but the production of large timber will prevent their being thrown open to the same extent as in the case of other reserves.

And again, efforts are now being made to revive the iron industry in the province, and, if they should prove successful, it will be necessary to set aside for this purpose certain forests in Chanda and Nimar. Fortunately both these districts are rich in forests, so that no inconvenience to the people will be caused by these measures.

3.—Demarcation of boundaries and of cultivated areas inside the reserves.

31. Assuming that the policy advocated above meets with approval, the first and most important measure to be attended to is the proper demarcation of the reserves. The areas hitherto known as first-class reserves are, on the whole, well defined by boundary marks and by cleared lines. In some instances the boundary marks are missing, and in a few others the lines are not kept as clear as they might be; but such instances are rare, and the defects can easily be remedied. In some of the blocks villages are found. A certain portion of these form enclosures in the reserves, and they are practically not part of them. In others villages have to be maintained to secure the necessary labour, and, as a matter of necessity, the people cultivate limited areas of land. In the latter case the people live in the reserves at the will and pleasure of Government. In most of these cases the boundaries of the villages have not been properly defined, and in some cases the areas are more scattered than is compatible with the proper management of the forests. It is essential that they should be concentrated as soon as possible. In the case of enclosures, the boundaries must be kept properly demarcated, in order to prevent encroachments, and, in the case of the forest villages, this is essential to prevent unnecessary damage to the surrounding forest.

32. The boundaries of the forests hitherto known as second-class reserves are in a very unsatisfactory condition. In most parts of the province they are at present undefined on the ground, and in many instances even disputed. Moreover, the areas are frequently cut up by cultivation, which has been permitted in them without fixing the limits within which it may be carried on. It is essential that the outside boundaries, as well as those of the cultivated areas, should be defined. This represents, however, a very large amount of work, which can only be accomplished by degrees. Hence the more important tracts, about which no doubt exists that they must be maintained permanently as forests, should be taken in hand first. When these have been disposed of, the rest will be taken in hand. During the progress of the

work, land which has been so cut up by cultivation that it has become practically useless for forest purposes should be taken out of the reserves altogether and made over to the exclusive management of the Civil authorities. Such exclusions, however, require the sanction of the Government of India (*vide* section 26 of the Forest Act).

Smaller areas of cultivation situated in the interior of valuable forests should, if the permission to cultivate is not withdrawn, be concentrated and permanently demarcated. They will then, as a rule, form forest villages, and their management will best be left to the forest staff under such rules as may be determined on.

33. A commencement in the above direction has already been made, especially in the Nimar, Nagpur, and Chanda Districts; but it is necessary that during the next few years all the available strength of the Department should be concentrated on this work, so as to bring it to an early conclusion. In the meantime it seems advisable to issue strict orders that no further cultivation leases shall be given in any reserved forest until the demarcation has been completed, and until it has been decided which parts of the second-class reserves must be maintained as forest and which may be given up for cultivation.

CHAPTER III.—ORGANISATION.

1.—Relations between District and Forest Officers.

34. The organisation of the Forest Department in the Central Provinces, as developed up to date, is somewhat complicated. Theoretically speaking, the first-class reserves are under the absolute control of the Conservator of Forests and his Officers, while the second-class reserves are under that of the Deputy Commissioners assisted by Forest Officers. In practice, however, the system has only partially been developed. In eight districts—Nagpur, Chanda, Wardha, Saugor, Seoni, Betul, Hoshangabad, and Nimar—the system has been fully introduced; in seven districts—Bhandara, Balaghat, Jubbulpore, Damoh, Mandla, Chhindwara, and Narsinghpur—the first class reserves are under the Forest Officers, and the second-class reserves under the Deputy Commissioners, who manage them without the assistance of superior Forest Officers; and in the three Districts of the Chhattisgarh Division all the reserves are as yet under the Deputy Commissioners.

35. The system of placing the second-class reserves under Forest Officers, who are subordinate to the Deputy Commissioners, was introduced in 1877, and the Chief Commissioner, in his review of the Forest Administration Report for 1881-82, states that "the system has, in his opinion, worked exceedingly well. There has been little or no friction; even at first starting there was but little friction, and that little has now disappeared. The District Officer has had the advantage of the professional skill of the Forest Officer in arranging for the management of second-class reserves, and the results in many districts have been signally good. Systematic management has been introduced, and revenue has increased. On the other hand, the Forest Officer has had his hands strengthened in the management of his own first-class reserves. It is quite true that when the permanent reserves that it may be found necessary to maintain have been separately demarcated, the question of placing such of them as are now managed by District Officers under the Forest Department will arise. It will probably be found expedient to place all permanent reserves under the Department. But that will not be any subversion of the system now in force. It will be but the transfer of some second-class reserve areas to the first class. The great object of maintaining the present close connection between the District and the Forest Officers is not only that the skill of the latter may be at the disposal of the former, but also that the present requirements and convenience of the people may be as fully as possible considered in deciding all questions of forest conservancy."

36. With such results already achieved, there can be no doubt as regards the future policy, which must be to extend the system to all districts in the Central Provinces, as soon as this can be conveniently done. Ultimately each district should have a separate District Forest Officer, who will be subordinate to the Deputy Commissioner and who will be in charge of all Government forests in the district. Whether the present distinction between first and second-class reserves is maintained or not will make no difference. Under either system, the management of the first-class reserves or the closed blocks, as the case may be, will be mainly dependent on the measures which the Conservator of Forests, as head of the Department, considers necessary; while in regard to all other questions the Deputy Commissioner and the Conservator of Forests must work in consultation, the former Officer being responsible for the executive work in the district, the District Forest Officer acting under his orders and issuing orders in his name.

37. The most important part of the system is, however, the introduction of an annual plan of operations for each district. In this should be set forth the manner in which it is proposed to work each forest, and the work to be done during the next year; it will be drawn up by the District Forest Officer and submitted to the Deputy Commissioner, who will either come to an understanding with the Conservator of Forests as regards its provisions, or, if they cannot agree, the Chief Commissioner will pass the necessary orders. When this plan of operations has once been settled, none of its provisions must be altered without the consent of both the Conservator of Forests and the Deputy Commissioner, or the orders of the Chief Commissioner.

Where a general working-plan has been drawn up for any forest and approved of by Government, the provisions of the annual plan of operations must be in accordance with those of the former.

2.—Forest Staff.

38. The chief difficulties which present themselves at present against the introduction into all the districts of the system described in the previous paragraphs are—

(1) that some of the forests are situated partly in one district and partly in another; and

(2) that the staff of superior Forest Officers is not sufficient to provide a District Forest Officer for each district.

The first reason does not appear to be of much importance. In some cases there is really no harm in dividing the forest into two or even three blocks, according to districts; and where the forest is so small that this arrangement does not appear practicable or advisable, there should be no difficulty in assigning it, for all administrative purposes, either to the one or the other district. It may even be practicable to alter the boundaries of the districts, so as to follow the outer boundary of the forest, instead of cutting through the middle of it.

39. As regards the insufficiency of the staff, it should be noted that there are 18 districts, while the superior forest staff at present sanctioned is as follows:—

Deputy and Assistant Conservators	...	14
Sub-Assistant Conservators	...	4
Total	...	18 Officers.

Putting aside for a moment the Chhattisgarh Division, 15 districts remain to be provided with District Forest Officers. It may be assumed that of the 14 Deputy and Assistant Conservators 10 are always on duty and fit to take charge of a Forest Division, while 4 may be put down as being under training or on leave. Thus the superior staff is sufficient to provide for 10 districts only, leaving 5 districts to be provided for, and this, it would appear, can be done by appointing Sub-Assistant Conservators to them.

The Dehra Dún Central Forest School is now in full working order, and one of its pupils has already been considered fit to fill the office of District Forest Officer in Wardha; while a second equally promising Ranger is now under training. Under these circumstances, it is considered that the five smallest and least important charges can, after a few years, be held by Sub-Assistants.

One Officer is always required to hold charge of the Office of the Conservator of Forests. Hence the number of Officers necessary for the old established Forest Divisions is as follows :—

Deputy and Assistant Conservators	...	14
Sub-Assistant Conservators	...	6
Total	...	20 Officers,

so that two additional Sub-Assistants would be required.

40. The three districts of the Chhattisgarh Division form a somewhat remote part of the Central Provinces, and the area of the Government forests in them is only about half of that in any of the other Civil Divisions. Moreover, forest management in that division is as yet somewhat backward, the Forest Department being now occupied in examining the forests. It is, however, most essential that the latter should at once be taken under proper management, especially as the division is about to be traversed by a railway. The most suitable arrangement will be to appoint to the charge of the Chhattisgarh Forests a senior Deputy Conservator, who should be assisted by three Sub-Assistants. The Deputy Conservator should be subordinate to the Commissioner of the Division, and the three Sub-Assistants should be brought into such official relations with the Deputy Commissioners of the three districts as may be found desirable.

Ultimately, when matters have further developed, it may be necessary to form three charges according to the three districts, as in the rest of the Central Provinces.

41. The present forest staff was sanctioned without any reference to the requirements of the Chhattisgarh Division, and it will be necessary to provide a staff in addition to that already sanctioned. Moreover, for 9 Sub-Assistants it will be necessary to have one supernumerary man. The total number of Officers required will therefore stand as follows :—

Deputy and Assistant Conservators ...	...	15
Sub-Assistant Conservators	...	10
Total	...	25

The additional staff required should consist of 1 Deputy Conservator on Rs. 550 per mensem and 6 Sub-Assistant Conservators.

Hitherto the Sub-Assistants have received a uniform pay of Rs. 200 per mensem each, while Forest Rangers rose up to Rs. 150 per mensem. As the Sub-Assistants will in future be recruited from the deserving Rangers, especially from those who have passed through the Forest School, it seems desirable to abolish the 1st grade of Rangers on Rs. 150 per mensem, and to arrange the Sub-Assistants into three grades on Rs. 150, Rs. 200, and Rs. 250 per mensem. The 10 Sub-Assistants of the Central Provinces might be graded as follow :—

	Per mensem. Rs.
4 Sub-Assistants on	150 each.
3 do. do.	200 „
3 do. do.	250 „

This scale would give reasonable prospects of promotion.

It should not, however, be overlooked that the system cannot be completely established until the full staff of 10 Sub-Assistants has been secured. At the same time, the arrangement will offer an excellent opportunity of showing

how far Native Sub-Assistants are fitted to discharge the duties of District Forest Officers.

42. Important as the organisation and arrangement of the superior staff is, the division of the forests into a series of executive charges or ranges, presided over by a competent staff of Rangers, is almost more so—a view which is also held by Major Doveton. At present the arrangement is, owing to the separation of the forests into first and second-class reserves, somewhat complicated, there being a separate staff for each of these two classes. As soon as this distinction has disappeared, all the Government forests should be arranged into suitable ranges, just as districts are divided into tahsils. The number of Rangers, which is 21 at present, will of course have to be considerably increased; but a number of low-paid Foresters can be discharged, so that the change is not likely to be accompanied by any great increase of cost, at any rate not at the outset. Major Doveton estimates that he will ultimately require about 60 Rangers; but this number will only gradually be worked up to, as the revenue from the forests increases and as trained men become available. It would be premature now to enter into the details of this scheme, which must be worked out gradually, as the organisation is perfected. The first step is to send annually a number of duly qualified men to the Central Forest School at Dehra Dun, with the view of their qualifying for the position of Forest Rangers. For the first few years the number might be fixed at four annually, while hereafter two per annum would suffice.

CHAPTER IV.—PROTECTION OF THE FORESTS.

1.—General Protection.

43. Before proceeding to sum up the results of fire protection, it should be stated that the general protection of the forests appears to be all that can be desired. Damage by illegal or irregular cutting occurs very rarely. Of course the restrictions against cutting in the second-class reserves refer, as a rule, only to a few species of trees; but even in the first-class reserves, where cuttings are in many cases prohibited altogether, no damage seems to occur. From these facts it may be concluded that the conservancy rules which have been enforced up to date are reasonable, and that they have not inconvenienced the people in any material way.

2.—Protection from Fire.

44. Ordinarily, all forests in the Central Provinces are liable to be burnt every year, and in consequence arrangements to protect certain areas against fire were initiated as early as 1864, before such steps on a considerable scale were taken in any other province. A commencement was made in that year by protecting the Bori Forest, and subsequently several others were added, so that the total area stood as follows on the 1st April 1872:—

Name of Forest.	Area, in square miles.	Year in which fire protection was commenced.
Bori	37	1864
Jagmandal	38	1867
Chuharigogarh	3	1867
Satpura [Korai Range]	49	1869
Hathibari	3	1870
Singrampur	10	1871
Bijeragoghar	33	1871
Barela	11	1872
Total ...	184	...

Since then additional blocks have been added every year until 1880-81, so that the total area has now risen to 1,413 square miles. The following table gives the results of fire protection during the last 10 years, as far as they can now be traced :—

Year.	Area, in square miles.		Percentage of Failures.
	Area attempted.	Failures.	
1872-73	226	...	...
1873-74	259	...	...
1874-75	333	...	...
1875-76	629	86	14
1876-77	809	20	2
1877-78	1,097	199	18
1878-79	1,171	91	8
1879-80	1,293	174	13
1880-81	1,444	85	6
1881-82	1,413	204	14
Average per year, during the last seven years ...			11

45. It is unfortunate that the fate of each forest cannot be traced during the earlier years of fire protection, nor can the percentage of failures before 1875-76 be given with any degree of accuracy. On the whole, it is believed that fire protection 10 years ago was proportionately more successful than it has been during the last seven years. The reason given for this is that the failures increased when certain areas were added which it was found specially difficult to protect, as for instance the Punassa, Chandgarh, and Bowergarh Reserves. Great efforts are, however, made to secure success in these areas, and, until this has been accomplished, it is not intended to extend fire protection to any considerable extent.

46. The system of fire protection may shortly be described as follows. Wherever the boundary is not formed by a river, precipice, or other natural feature which in itself is sufficient to keep out fire, it is cleared to a breadth of from 60 to 300 feet, according to circumstances, partly by cutting and partly by burning. In addition, a certain number of interior lines are cut and burnt, varying in breadth from 10 to 200 feet. Throughout the dangerous season extra fire guards are employed, who patrol the cleared fire lines of the protected areas, and who sweep away any inflammable material which may be found on them. As a matter of course, the regular establishment is expected to be specially on the alert during this season. The average cost per year during the last 5 years comes to 2·86 pies per acre of area attempted to be protected. This is at the rate of about Rs. 10 per square mile.

47. From a careful examination of the effects of fire protection, it is evident that the money spent on this branch of forest work has been well laid out. Of the areas under protection, the Ahiri, Jagmandal, and Bori Reserves may be specially mentioned, where the effects are most marked. The Ahiri Forests have been protected, partly since 1872 and partly since 1875. The total expenditure incurred on behalf of the Bhimaram block since 1872 comes to about 14 annas per acre; and by this outlay the area has been fully stocked with young teak and other trees, the value of which is equal to many times the outlay. The young growth in the parts protected since 1872 is indeed most promising, and it covers the ground so completely that the old trees will have to be cut out and brought into the market at an early date.

The Jagmandal Reserve has been protected since 1867, causing a total cost of 12 annas per acre. Here the old stumps of teak and seedlings formerly burnt annually have sent up strong shoots, the largest of which, 14 years old, measured up to 20 inches in girth at height of chest from the ground. A very large proportion of the area has thus been stocked with valuable material. But, in addition, most of the smaller blanks, and strips along the edges of large blanks, have been stocked by self-sown seedlings,

many of which are teak. On the other hand, the central portions of the large blanks, where seed-bearing trees were wanting, require artificial help in the way of sowing or planting.

In the Bori Forest the cost of fire protection since 1864 comes to about 8 annas per acre, and the result is that a very valuable stock of teak poles has been raised, which represents a very much higher value than what has been spent on fire protection.

48. Against such instances, cases must of course be set off in which success has been less complete, as for instance the Barela Reserve, which, though fire protection commenced in it in 1872, was burnt over in 1879. The fire did of course great damage, but still it did not undo all the good done before by 7 years' protection. A good many young teak trees had grown to such a size during the 7 years of protection that they were able to withstand the fire, though most of the smaller seedlings were of course cut back. Since 1879 a fair number of shoots and seedlings have made their appearance, and there can be no doubt that, if the reserve is successfully protected during the next five years, it will be fairly stocked throughout. The total cost per acre has been only $3\frac{1}{2}$ annas.

49. On the whole, there is reason to be satisfied with the results of fire protection, and, as soon as the areas so far under protection have been made safe, further extensions may be considered. The area at present attempted amounts to 1,413 square miles, which is a little more than one-half of the area of the first-class reserves. Ultimately, not only the whole of the present first-class reserves, but also a considerable proportion of the second-class reserves, must be protected; in fact, all closed blocks, which would comprise up to one-half of the area of all reserves. Going too fast is, however, strongly to be deprecated; it is essential that more areas should not be taken in hand than can be effectually made safe within a reasonable time.

In the meantime, it is for consideration whether, in addition to the areas specially protected, a large portion of the reserves could not be protected to some extent without the clearing of boundary and interior lines. If the people were thoroughly impressed with the knowledge that the burning of the Government forests is not permitted, and that any area burnt is liable to be closed against grazing and cutting for a certain period, it is quite possible that large areas might be saved annually without expense to the State.

CHAPTER V.—CULTURAL OPERATIONS.

1. Sowing and Planting.

50. Although Form No. 50, Area of Plantations, which is usually appended to the Provincial Annual Reports, is blank in the case of the Central Provinces, it must not be concluded that sowings and plantings have not been attended to. On the contrary, various experiments have been made, but the areas thus stocked have not been classified as regular plantations, and consequently they have not been shown in Form No. 50.

51. The following are the principal instances of sowing and planting.

Regular Plantings and Sowings.

(1)—Ahiri (Mandla).

Between the years 1867 to 1870 an area of 70 acres was planted with teak, mostly 7 feet by 7 feet. The locality is situated on trap, partly on a low level along the Bormeyr river, and partly on undulating ground. The plantation was, some years ago, considered a failure; but, according to the latest reports, a good deal of teak is now coming up on the area.

(2)—**Garhakota** (Saugor).

Between the years 1864 and 1869 about 15 acres were planted with teak, 7 feet by 7 feet. In parts of the area sandstone beds are close below the surface, with shallow soil; but in other parts the soil is fairly good, though somewhat stiff. The locality is partly flat and partly undulating. The plants have suffered severely from frost, but still a considerable number of saplings have survived, though the results are, on the whole, unsatisfactory.

(3)—**Baka-Barda** (Bowergarh Reserve in Betul).

On undulating ground, sloping from a range of hills on the north towards the Machna river on the south, an area of 95 acres was, between the years 1867 and 1871, planted with teak, 7 feet by 7 feet. The richest part of the plantation, situated on the bank of the Machna river, was carried away during heavy floods in 1877. The remaining area is fully stocked, but a portion of the plantation has suffered from frost. The trees thus injured are being cut over, to produce fresh shoots; but only parts of the trees are cut back at one time, while those remaining are expected to provide shelter for the fresh shoots. In the parts of the plantation which were not touched by the frost, thinnings have already been made.

(4)—**Hathibari** (Bilaspur).

An area of 130 acres, situated on undulating and low ground, was planted between the years 1868 and 1870 with teak, 7 feet by 7 feet. The drainage of the area is insufficient, and parts of it are subject to inundations. Except in a few places on the higher levels, the results are unsatisfactory.

(5)—**Satpura** (Seoni).

(*a*) *Sonawani.*—In 1867 one acre was planted with teak on a high open ridge, well drained and slightly sloping down on all sides. The place is said to have been used formerly as a cattle-pen, and the ground was highly manured when the young plants were put in, 6 feet by 6 feet. The cover is complete, and no grass or shrubs exist on the ground. The trees are well shaped. The following are the results obtained by measurements made in February 1876 and in January 1883:—

Year.	Average height, in feet.	Average girth at height of chest, in inches.
1876	35	12
1883	55	17
Increase in 7 years ...	20	5

(*b*) *Sakata.*—In 1868-69 about 5 acres were planted with teak, 7 feet by 7 feet. In 1876 the trees measured on an average 21 feet in height, with a girth of 8 inches at height of chest. The cover is complete, but many trees have formed side shoots, and they are all branched low down. It is believed that fire has entered the plantation.

(*c*) *Korai.*—In this range an area of 243 acres has been sown with teak, blackwood, bija, rohan, saj, khair, and *Gmelina arborea*. On about 68 acres all the jungle was cleared away, but on the rest of the area the shrubs and inferior trees on the ground were only lopped, in some places twice. The sowing was done in various ways. In most parts pits were worked 12 inches deep, the pits being situated 4 feet apart and arranged in lines 6 feet apart. On 50 acres seed was sown in ploughed bands 3 feet wide, the bands being about 20

feet apart. On the whole, the results are fairly satisfactory; the young trees have been somewhat slow in coming on, but they are now beginning to show, and they promise to make a good forest. The clearing of the jungle was, of course, a mistake, and it has not been repeated of late years, as the young seedlings require some protection during the first few years of their life, irrespective of the fact that it is desirable to produce mixed forests.

(*d*) *Telia.*—Twelve acres were sown with teak and bija in 1877. The bija failed almost entirely, but the teak has stocked the area fairly well.

(*e*) *Rukur.*—About 50 acres were sown in 1877 with teak, blackwood, saj, rohan, bija, and khair, in bands 2 feet wide, which were arranged 10 feet apart. Bija and rohan have failed; on the whole, the results have not been satisfactory.

(6)—**Moharli** (Chanda).

Between the years 1876 and 1879 upwards of 27,000 teak plants were planted out, partly in 100-feet broad bands cleared in natural forest, and partly in open spaces in the forest. In the former bamboos have sprung up, and the trees cut back at the time of sowing have sent out fresh shoots, between which the young teak trees are coming on very well. In the open spaces near the Ambari river the plants are doing fairly well, but in other places the results are unsatisfactory.

(7)—**Ahiri** (Chanda).

About 3,600 teak plants were put out in 1876, in narrow lines cleared through the natural forest, where teak was wanting; but reproduction generally has been so favourable in this forest that the plants put out have been lost sight of amongst the natural seedlings.

(8)—**Garhakota, Hathkho, and Rangir** (Saugor).

Between the years 1879 and 1882 upwards of 120,000 bamboos were put out, of which about one-half are reported alive.

A small batch of bamboos (*Dendrocalamus strictus*), planted in 1873 in Garhakota, yielded their first outturn of good bamboos in 1881-82, so that eight years may be taken as the time in which artificially-raised bamboos of this species will, under ordinary circumstances, in this locality commence to yield a return.

(9)—**Kergaon** (Khandwa Reserve in Nimar).

In 1879 the following areas were planted:—

500 acres, 15 ft. by 15 ft., with bamboos.
106 „ „ „ „ with bamboos and teak, in alternate lines.

The results were not satisfactory.

In 1880 some 10½ lakhs of pits were planted and sown, but the results were again altogether unsatisfactory.

In 1881 further plantings were made, but also with little success.

Cheap Sowings.

52. In addition to the more regular planting operations indicated above, a series of cheap sowings were made, of which the following deserve to be mentioned.

(1)—**Kalibhit** (Hoshangabad).

In 1876-77 about 100 acres, consisting of old fields, were roughly ploughed and sown broadcast with teak seed previously soaked, but there were no results.

(2)—**Punassa** (Nimar).

In 1876-77 one hundred acres were sown in the same way with teak, saj, and bija. No results.

(3)—**Saolighar** (Betul).

In 1877-78 one hundred acres were sown with teak, bija, saj, tinnas, and blackwood in a similar manner. No results.

(4)—**Khamapur** (Betul).

In 1877-78 about 177 acres were sown with teak and other species, in prepared lines. No results.

(5)—**Rajaborari** (Hoshangabad).

Two hundred and seventeen acres were sown broadcast in 1877-78 with tinnas, saj, and bija. No results.

(6)—**Rajaborari.**

Over part of the above area teak was added in prepared plots, 6 feet by 12 feet. Only a few seedlings remain now.

(7)—**Bori** (Hoshangabad).

In 1877-78 a small area was sown with teak, in ploughed bands 3 feet wide, the bands being 20 feet apart. The whole area was also sown broadcast with blackwood, tinnas, and bija. The results are unsatisfactory.

General remarks on Sowing and Planting.

53. The operations so far undertaken were all of an experimental nature. Where planting was done systematically and the planted areas looked after for some years, success has been obtained, as for instance in the Satpura Reserve; but where a more rough system was tried, the results are disappointing. Broadcasting especially has given little or no result.

In the Central Provinces the operations of the Forest Department extend over very large areas; the rainfall is often fitful and irregular, the average ranging from 32 to 78 inches per annum, and systematic planting is necessarily expensive. Considering the satisfactory effect of fire protection upon re-production, it follows that the renewal of the forests must be chiefly effected not by planting, but by protection against fire and grazing. Only where large blanks exist, and where it is desirable to improve the composition of the forests, should sowing and planting be resorted to. In such cases a beginning should be made in the blanks which exist along the boundaries of fire-protected forests. It will be advisable to make the boundaries as safe as possible against fires running in from outside, and this can probably best be done by planting and sowing suitable trees in lines or in bands in all blanks along the boundaries. When some progress has been made in this way, it may be advisable to plant bands or patches in large blanks situated in the centre of the reserves, so as to produce seed-bearing trees, which will ultimately help to stock the whole area.

Operations might be commenced in the—

Jagmandal	Reserve	...	...	...	... Mandla,
Banjar	„	...	...	...	... Ditto,
Satpura	„	...	...	...	... Seoni,
Ahiri	„	...	...	...	... Chanda,
Bori	„	...	...	...	... Hoshangabad,
Punassa	„	...	...	...	... Nimar,

and be gradually extended to the other important reserves. This will occupy the Department for many years to come; it is essential that the work should be commenced on a moderate scale, and that the operations should not be extended until success has been attained.

Rough methods of treatment do not apparently answer, and it will be necessary to nurse the plantings until they can shift for themselves. Under these circumstances, the bands or lines should not be too close together, so as to reduce the expenditure. Thirty feet may be found a convenient distance, but there is no objection to increase it to fifty feet. Within the lines the plants should, however, be close together, say from 3 to 5 feet. Experience will show whether sowings or transplants will answer best. Under any circumstances, all natural growth should be left on the ground, to assist in sheltering the young plants during the first years of their life.

2.—Coppicing of Teak.

54. An important measure, which has received considerable attention, is the cutting back of badly-grown teak trees, with the view of obtaining fresh and well-grown shoots from the stumps. Throughout the forests of the Central Provinces large quantities of teak saplings and poles of inferior quality are met with. These have either suffered from the effects of fire, cutting, or other causes, and they are not likely to yield good timber. Under these circumstances, a commencement was made, as early as 1866, to cut such inferior poles and saplings flush with the ground, and to let the stumps send up fresh shoots. These operations have been carried out in many forests, of which the following may be specially mentioned.

(1)—Bori (Hoshangabad).

In 1866-67 a number of teak trees were cut back, in connection with the clearing of saplings; there is, however, no record of the transaction.

(2)—Punassa (Nimar).

Between the years 1873 and 1879 all badly-grown trees, except those required for seed, on a considerable area, of which about 20 square miles contained teak, were cut over. The numbers then cut cannot be given for all years; but it may be mentioned that 61,101 trees were cut in 1877-78 and 10,235 trees in 1878-79. Major Doveton inspected these areas in 1880-81, and he considers the results satisfactory, nearly all the stumps having sent out fresh shoots, which are much more promising than the old stock. Frost has, however, done a good deal of damage, in 1878-79 and 1879-80, in the lower and better parts of the forest. In the higher and poorer parts it has done little or no damage.

(3)—Rajaborari and Saplighar.

The following cuttings have been made:—

In 1873 to 1875	...	...	over 13 square miles.
„ 1876 to 1878	...	...	30,000 teak trees.
„ 1878-79 ...	...	...	28,423 „
„ 1879-80 ...	...	...	24,461 „
„ 1880-81 ...	...	...	7,288 „

The results of these cuttings are good.

(4)—Satpura (Seoni).

In the *Korai* Range 34,326 teak trees were cut back during the years 1877 to 1881. These cuttings were carefully examined in January 1883, and were found to be everything that could be desired. The stumps, with the exception of a small percentage, have sent up well-grown shoots.

In the *East Pench* Range 2,028 trees were cut over in 1877-78, with good results.

(5)—Kalibhit (Hoshangabad).

During the years 1873 to 1875 an area of 2½ square miles was cut over.

(6)—Khamapur (Betul).

The cuttings carried out in 1874-75, and which extended over a small area, were not followed by satisfactory results, owing to damage done by frost.

(7)—Hathkho (Saugor).

In 1876-77 the teak trees on 500 acres were cut over, with fairly good results.

Other cuttings were made in Chandgarh, Khandwa, and Bowergarh.

55. The material obtained by these cuttings has been sold, and it has realized considerably higher sums than the cost of cutting and stacking it. Taking into consideration the great improvement effected by these measures, there can be no doubt that the cuttings should be steadily continued. As a matter of course, they should be made in fire-protected areas. In frost localities the cuttings should be made very carefully. To prevent the young shoots being injured, it is necessary to have some shelter on the ground, which frequently may be given by cutting only some of the trees, leaving the others to act as nurses until the crowns of the new shoots have got above the frost region.

CHAPTER VI.—WORKING OF THE FORESTS.

56. As the Government Forests of the Central Provinces, though reserves under Chapter II of the Forest Act, have to supply not only public works and industrial enterprises, but also and chiefly the ordinary requirements of the people of the country, they are worked in a variety of ways to suit the demands made on them. On the whole, the methods of working may be brought under the following four heads :—

(1) Commutation.
(2) The License system.
(3) The Kham Tahsil system.
(4) Government Agency.

It will be useful to explain shortly what each of these systems means.

1.—The System of Commutation.

57. Under this system is generally understood the payment of a fixed sum per annum, in return for which the payee may supply himself with certain classes of forest produce. The payment may be fixed—

(1) by the plough;
(2) by the house;
(3) by the land revenue; or
(4) by the income of the payee.

And, again, the payment may entitle the payee to the removal of—

(*a*) any forest produce required for domestic purposes
(*b*) any forest produce, except timber or bamboos; or
(*c*) certain articles only.

Grazing is, as a rule, not included in commutation, but must be paid for separately, according to the number of cattle sent into the Government forests. In some cases each individual takes out a grazing license, in others arrangements are made for whole villages.

Ordinarily, commutation is not granted unless the whole village commutes; but in some cases this rule has been set aside. The commutation passes are issued either by the forest establishment, or the tahsildars, or special vendors. According to the information supplied, the system is at present in force in the following districts:—Bhandara, Balaghat, Chanda, Seoni, Saugor, Betul, Nimar, Chhindwara, Raipur, and Sambalpur. The details of the system and the rates payable differ according to districts. The rates per annum range from 2 annas to Rs. 2 per house or plough. In some cases restrictions are enforced as regards the quantity of each kind of produce which may be removed; in others no limit has been fixed beyond what is required for ordinary domestic purposes.

58. As an instance of the manner in which the system is worked, the following details referring to the Bhandara District may be given. The villages which are allowed to commute are those which are situated in close proximity to the forests. The people are divided into Agriculturists and Non-Agriculturists, who pay at the following rates:—

Agriculturists—from 4 annas to Rs. 2 for each plough, according to circumstances.

Non-Agriculturists—are assessed according to their income and are divided into the following classes:—

		Rate. Rs. A. P.
Class I,	Incomes not exceeding Rs. 50 per annum ...	0 2 0
Do. II,	ditto ditto 150 ditto ...	0 6 0
Do. III,	ditto ditto 300 ditto ...	0 12 0
Do. IV,	ditto ditto 500 ditto ...	1 4 0
Do. V,	ditto exceeding Rs. 500 ditto ...	2 0 0

The commutation licenses are for the official year, and they are issued by the Forest Establishment. They cover the removal of the following articles:—

(1) Firewood and dead leaves.
(2) Wood for fencing and for repairing houses.
(3) Wood for ploughs.
(4) Grass for thatching.
(5) Bamboos.

Firewood comprises the following articles:—

(*a*) dead or fallen timber of the unreserved kinds;
(*b*) branches of unreserved kinds of wood;
(*c*) brushwood, thorns, and undergrowth generally.

The following kinds of trees are reserved, and they cannot be cut without the permission of the Deputy Commissioner (or the Forest Officer under his orders):—teak, blackwood, saj, sal, bija, mohwa, and achar.

On the whole, the system of commutation has been discouraged of late years, as it leads in many instances to waste of material. It is now considered a fairer arrangement that the people should pay according to the quantities which they remove, and this has led to the license system.

2.—The License System.

59. Any person requiring produce from a Government forest takes out a license before proceeding to the forest, for which he pays at certain rates fixed according to circumstances in different parts of the country. The rates are fixed per cart, head, or other load, or per quantity in maunds or cubic feet.

They vary considerably in different parts of the province. The following are some of the rates in force in the Chanda District:—

Forest Produce.	For the residents of the District.	For outsiders.
	Per cart load.	Per cart load.
	Rs. A. P.	Rs. A. P.
Timber	0 4 0	3 0 0
Firewood	0 1 0	0 4 0
Bamboos	0 4 0	2 8 0
Grass	0 1 0	0 4 0
Grazing.	Per head, annually.	Per head, annually.
Buffalo	0 2 0	0 3 3
Bullock or Cow	0 1 0	0 2 3
Sheep or Goat	0 0 3	0 0 6

To make it as easy as possible for the people to obtain the licenses, they are sold by the Forest Establishment, Post-Masters, Police Officers, Tahsil Establishments, School Masters, or private individuals duly authorized to meet requirements. The license vendors, except those belonging to the Forest Establishment, receive a commission on the sales. The licenses are either for fixed values or they are not. The former are of two classes: one gives the details of the produce; and the other only the value, so that the purchaser can remove under it any produce he chooses up to the value of the license. The licenses of no fixed value show the details of the produce which may be removed under it, and the amount paid.

60. The license system has been much elaborated in the Central Provinces, as it is the most suitable method of disposing of the forest produce, and is at the same time fair to the consumer. In some cases the description of the produce is indicated by the colour of the paper on which the license is printed; in others the license is illustrated by a picture of the produce to which it has reference, as for instance a man carrying a head-load of grass, or a bullock carrying a load, or a cart with two bullocks and laden with grass or timber, &c. In other cases the value is indicated by printing the *fac-simile* of the coin in question on the license; for instance, a four-anna piece printed on a license indicates that four annas' worth of produce may be removed under it. And, again, in other instances the value is represented by stamps affixed to the license.

The objects of all these measures and devices are—

(1) to facilitate the purchase of the licenses,

(2) to prevent the purchasers being cheated, and

(3) to facilitate the control over the produce removed by the Forest Guards, who, as a rule, are not able to read or write, but who know the value and purport of the licenses by the colour of the paper, *fac-similes*, &c., indicated above.

3.—The Kham Tahsil System.

61. A modification, though by no means an improvement, of the license system is the kham tahsil system, under which the purchaser proceeds to the forest without let or hindrance, removes the produce he requires, and pays for it, on passing out of the forest, at one of a series of stations established on the main lines of export.

The kham tahsil system, if applied to forests which it is intended to maintain permanently, has serious drawbacks, which it is not necessary to

explain here, as the system is in force in one forest only, the Moharli Reserve, and as it is not intended to extend it. There were special reasons why the system was applied to the Moharli Reserve. In the first place, the exports from it form as yet only a fraction of the possible yield, and the exporters do not cut the material, but they buy it from certain people living in forest villages in the reserve, who cut and prepare the produce for sale. When the demands on the reserve have sufficiently increased to approach its possible yield, a change in the system will be called for. In the meantime, it may be mentioned that the Ranger in charge of the reserve controls the Naka Establishment.

4.—General Remarks on these three systems.

62. Considering the above-mentioned three systems generally, it will be noticed that they, in themselves, put very little restriction on the manner in which the forests are used by the people. In order to maintain and improve the areas, certain restrictions are, however, enforced. It has been shown in a previous Chapter that the area of the Government Forests on the 1st April 1882 stood as follows :—

	Area, in square miles.
First-class Reserves	2,588
Second ditto	16,842
Total ...	19,430
Add Unreserved Forests	289
Grand Total ...	19,719

In the first-class reserves certain blocks only are opened for the exercise of the commutation, license, and kham tahsil systems; while the others are under reproduction or special improvement. In some instances certain inferior species may be cut anywhere in a first-class reserve; but care is taken to give this permission only where it is not likely to lead to damage. And even in the open blocks valuable species—like teak, sal, bija, saj, blackwood, and others—may only be cut with the special sanction of the Divisional Forest Officer. Bamboos are, on the other hand, so abundant in most first-class reserves (certain areas in the northern part of the province excepted) that no restrictions regarding their removal have as yet been enforced. As the demand increases, it will no doubt be found necessary to work even bamboo forests by rotation, so as to ensure the continued production of good healthy shoots.

63. In the second-class reserves working by rotation has been attempted by opening certain blocks for cutting and by closing others; this, however, refers only to a small part of the area (Seoni and Saugor Districts). The ordinary restriction which has been enforced consists in the prohibition to cut the more valuable species, varying in number according to circumstances, without the previous sanction of the Divisional Forest Officer, or the Deputy Commissioner, as the case may be. With this simple restriction, the second-class reserves, it is believed, have not deteriorated since they were taken under protection; on the contrary, in many instances they have even improved; but in the same degree as the Malguzari forests disappear or are reduced in yielding power, and the demand on the Government forests increases, it will be necessary to introduce additional conservancy measures. The second-class reserves will, similar to the method now followed in some of the first-class reserves, have to be divided into blocks, of which some are open for cutting, while others are closed for reproduction and improvement, until, in fact, all difference between first and second-class reserves disappears.

5.—Working by Departmental Agency.

64. Apart from the cutting back of badly-shaped teak poles, which has been dealt with in the previous Chapter, departmental working has been adopted in a few forests only. In the Wardha District grass and fuel are brought into the stations of Wardha and Arvi in limited quantities, because private enterprise has failed to supply these commodities in sufficient quantities. Occasionally produce has been collected departmentally in other localities for similar reasons, or to counteract combinations, or for other purposes; but, on the whole, these transactions are of very limited extent. Real departmental working is only carried on in two forests, the Banjar and Ahiri Reserves.

Working of the Banjar Reserve.

65. The sal forests on the Maikal Range, between the Banjar and the Bormeyr rivers, are described in detail on pages 14 to 22 of Mr. Brandis' "Suggestions regarding Forest Administration in the Central Provinces," 1876. Under these circumstances, it will suffice to recapitulate here a few facts regarding these forests, and to add the further information which has become available since 1876. These forests are the following :—

Name of Forest.	Area, in square miles.		
	Sal area.	Forest not containing sal.	Total.
Banjar	30	48	78
Topla or Halun	25	46	71
Keolakhapa	6	4	10
Motinala	3	—	3
South Phen	20	52	72
North do.	6	4	10
Total ...	90	154	244

The areas shown as covered with sal forest are a rough estimate; but it may be assumed that the total of 90 square miles is pretty near the mark. The sal areas are interrupted or surrounded by open grass lands, or by forest of other trees mixed with bamboos, which only in a few instances contains teak. In some parts the sal stands in an undergrowth of bamboos; but it has been noticed that with protection the sal gradually drives out the bamboos, and this result is to be regretted.

66. These forests have been worked more or less since 1866, when some logs were supplied to the Public Works Department. In 1869 and 1870 about 30,000 broad-gauge sleepers were sold to the Great Indian Peninsula Railway Company. In 1874 upwards of 500 logs and scantlings were brought to Jubbulpore, which realized from Rs. 1-3 to Rs. 1-11 per cubic foot. In 1875 another batch of 446 logs was brought out. Since then the forests have been steadily worked, but only dry and fallen trees have been removed. The stock of old timber having all been worked out, it was decided to fell annually 700 green sal trees, and a commencement was made in the Banjar Reserve in February 1882. None of the fresh timber has reached the sale depôt up to date.

67. Regarding the financial results of these operations during the earlier years not much can be said now. The receipts and charges of the five years ending on the 31st March 1882 were as follow :—

Year.	Receipts. Rs.	Charges. Rs.
1877-78	7,286	21,583
1878-79	22,047	29,949
1879-80	24,391	35,170
1880-81	33,669	22,433
1881-82	20,833	16,656
Total ...	1,08,226	1,25,791

These data exhibit a deficit of Rs. 17,565 during the five years. It should, however, be stated that the charges include the cost of the whole establishment employed on the works and a share of the Divisional Officer's pay. During the five years in question a sum of about Rs. 10,000 was expended on the removal of obstructions in the Nerbudda and Banjar rivers, and on the construction of roads. Besides, two Officers were employed on these works on probation, and the cost of one of these officers alone amounted to about Rs. 12,000. On the whole, it may be said that there was no deficit on the actual timber operations. Henceforth the outturn will consist chiefly of fresh cut timber, which will, of course, fetch much higher rates than the old timber found lying in the forests.

68. The first question which presents itself is—what number of trees may safely be cut annually? The available data referring to the growing stock are as yet very scanty. It is known that about 90 square miles are covered with sal forests, but it is also known that the stocking is very uneven, the best forest being found in the Banjar Reserve. In 1882 a very careful valuation survey was made in the latter, extending over 1,023 acres, which gave the following results per acre and for the whole reserve:—

		Per acre, approximately.	For the whole forest.	
I Class	Sal trees, above 6′ girth	... $\frac{1}{5}$	9,000	
II	Do. 4′ 6″—6′ „	... $\frac{1}{2}$	27,000	
			———	36,000
III	Do. 3′—4′ 6″ „	... $2\frac{1}{2}$		127,000
IV	Do. 1′ 6″—3′ „	... 9		447,000

The sal area of the Banjar Reserve is about one-third of the total sal area of the Maikal Range forests; but it contains much more than one-third of the total number of first and second class trees, which is not likely to be more than 60,000.

Unfortunately, no data are available regarding the rate of growth in these forests; but, judging by what is known in that respect of other localities, and assuming that the estimate of 60,000 first and second class trees is approximately correct, it will be perfectly safe to cut annually 1,000 trees of 4′ 6″ girth and upwards measured at height of chest, especially if it is remembered that the number of trees of the third and fourth classes is a multiple of that of the first and second classes. It should further be stated that the reproduction of sal in the Banjar Reserve is everything that can be desired. In short, the Department may safely remove 700 trees per annum, and even increase that number to 1,000 trees, if necessary or desirable.

69. The trees cut in 1882 were well selected, only those which stood over a good young growth having been marked for cutting. This system should be adhered to during the first period. As a great portion of the sal localities are liable to damage by frost, great care must be taken to leave in all such localities sufficient cover on the ground, to protect the young growth against frost. All trees now left for this purpose can be removed in the second period, when the young growth will be sufficiently advanced to take care of itself.

70. The selection of the trees to be felled must in all cases be done under the personal supervision of a competent Officer of the superior staff; but it is not necessary that the trees should be worked out by Government agency; and if it is practicable to dispose of them in the forests at reasonable rates, it would be advisable to do so. All that is required in this case is to see that no avoidable damage is done in felling the trees and in removing the timber. It is, however, very doubtful whether the trees can be thus sold for some time to come. The trees to be removed during the first period are in many

instances badly-shaped and unsound; moreover, there are considerable obstructions in the Nerbudda river, which make floating difficult, and it is therefore probable that the timber will have to be brought to market by departmental agency, at any rate for some years to come.

71. Under the present system of working, the timber is carted on Government and private carts from the block where cutting is going on to Khana, which is situated in the centre of the Banjar Reserve, and thence to Mocha on the Banjar river, the distance from Khana to Mocha being ten miles along a road constructed by the Forest Department. At Mocha the timber is lashed to bamboos with rope made of the *Bauhinia* creeper. Every cubic foot of sal requires about four bamboos to keep it well afloat. Each raft comprises generally 3 rows of 20 broad-gauge sleepers, or a corresponding number of logs; they are taken down to Mandla, a distance of 30 miles. The Banjar river, from Mocha to its junction with the Nerbudda, is now free of obstructions; but immediately below Mandla the Nerbudda is blocked up by several bars of soft trap rock. It is considered necessary therefore to land the timber and to take it over land to Sukrighat, a place seven miles from Mandla, below the obstructions. From Sukrighat the timber is floated to Gwarighat, near Jubbulpore, where it is sold.

72. The obstructions in the Nerbudda are a great drawback to the transport of the timber. There are two ways of meeting the difficulty. One is to land the timber and to carry it over land for a distance of about seven miles, and the other is to open out a passage through the obstructions. The former plan involves the construction of several miles of road and of a landing stage. Moreover, the landing and carting will be a perpetual charge. The clearing of a passage for rafts has already been commenced, by blasting a passage about 180 feet long through the obstruction called the Premadhar, situated close to Mandla, at an expenditure of Rs. 2,300. The main obstruction, the Shezdhara, about 3 miles below Mandla, is 3,600 feet long, with a fall of 40 feet, three-fourths of which occur in the last 1,200 feet. The average fall is one in ninety. It is estimated that to blast a passage through this obstruction would cost about Rs. 50,000. There is also a further obstruction a few miles lower down, which it would cost about Rs. 10,000 to remove. The question is, therefore, whether to spend, say, Rs. 60,000 in opening the Nerbudda for floating, or to construct a road and cart the timber round the obstructions. At present the Forest Department land the timber and cart it round by a road which is only passable during the dry season; but it appears that the people, when they take timber down on their own account, unfasten the rafts and take the logs one by one over the rapids and obstructions.

73. Assuming that the opening of a passage through the obstructions involves an expenditure of even Rs. 75,000, the interest on the outlay will amount to Rs. 3,000 per annum only, an amount which will be less than the interest on the cost of the roads and a landing crane *plus* the cost of landing and carting. Besides, if the timber is landed and carted, constant supervision will be required; while, when a passage through the obstructions has once been opened, the floating will go on without special supervision. There is, besides, another reason why the latter plan is much the best. As long as these obstructions exist, private parties are not likely to come forward and buy the trees in the forest; while, when the Nerbudda has been opened out, it will probably be practicable to discontinue departmental operations in these forests. On the other hand, if a Railway should be constructed from Jubbulpore in a southerly direction to join the Chhattisgarh line, it would probably require all the timber which can, for many years to come, be removed from these forests.

On the whole, therefore, it seems advisable to postpone coming to a final decision for a few years, until the question of the railway has been decided; in the meantime temporary arrangements for the transport of the timber should be made.

74. Regarding the financial aspect of future operations, the following data may be added :—

	Rs.	A.	P.
Cost of cutting a broad-gauge sleeper and delivering it at Gwarighat	2	0	0
Price obtainable per sleeper at Gwarighat	3	12	0
Surplus per sleeper ...	1	12	0

	Rs.	A.	P.
Cost of cutting and delivering first class timber in the log at Gwarighat, per cubic foot	0	14	0
Average selling price	1	8	0
Surplus per cubic foot ...	0	10	0

Under these circumstances, there should be no difficulty in making the operations pay, now that the cutting of fresh timber has been commenced. It is, however, essential that only really first class pieces are taken to Gwarighat in the log; while all others should be cut up into scantlings in the forest, so as to save the cost of carriage of inferior pieces, which would only bring low returns.

Working of the Ahiri Forests.

75. As a detailed account of the Ahiri Forests will be found in Appendix B, it will not be necessary to do more here than to draw attention to some of the main features of their working.

About the year 1868 negotiations were commenced with the Zamindar of Ahiri to purchase certain teak forests in his estate, and they were brought to a conclusion in 1873 by the acquisition of two blocks of forest land, measuring 20,000 acres, at a purchasing price of Rs. 1,00,000. Of this sum Rs. 20,000 were paid in cash, and the remainder was converted into a perpetual annual rental of Rs. 4,000. Subsequently an additional block of 766 acres, required for depôt purposes, was acquired by exchange, so that the areas on the 1st April 1882 stood, according to the latest survey, as follow :—

	Acres.
Bhimaram block	12,296
Mirkullu block	8,479
Total ...	20,775

or 32 square miles. These blocks have been declared reserves under Chapter II of the Indian Forest Act, 1878.

The Government also entered into an agreement with the Zamindar for the exclusive right to buy teak and other trees from the remaining forests of the Zamindari, the trees to be paid for at certain rates, as they are required.

76. In course of time, the boundaries of the above-mentioned two blocks were found to be in many instances unsuited for protection against fire; moreover, a strip of forest not belonging to Government runs between the two blocks, and thus forms a standing danger from fire. The Zamindar had also got deeply into debt, and he applied to Government either to buy from him an additional area of about 60,000 acres for Rs. 60,000, or to permit him to dispose of it otherwise. Under these circumstances, the Government decided to buy the land, so that the purchases now form one continuous block of forest covering an area of about 80,000 acres. As the new land is only just being taken over, it will be understood that the following remarks refer only to the original area of 20,775 acres and to the lease to buy timber from the rest of the Zamindari.

77. The working of the Ahiri Forests was commenced in a systematic way in 1871, and the financial results for the eleven years from 1871-72 to the end of 1881-82 are as follow:—

	Rs.
Total Receipts	9,04,172
„ Charges	9,05,729
Cash Deficit	1,557

The expenditure includes, amongst other items, besides the pay of establishments, the following charges:—

	Rs.
(1) Part-purchase money	20,500
(2) Interest on purchase money for one year	5,000
(3) Purchase of timber before the blocks were taken over, and under the lease	58,976
Total ...	84,476

On the other hand, a sum of Rs. 24,000, paid on account of the annual rental, has not been shown in the forest accounts. The stock has, however, considerably increased in value during the last 11 years, so that the balance sheet stands in reality as follows:—

	Rs.	Rs.
Actual Receipts		9,04,172
Expenditure—		
Cash paid by Forest Department ...	9,05,729	
Add paid by Civil Department	*24,000	
Total ...	9,29,729	
Deduct part-purchase money	20,000	
		9,09,729
Cash Deficit.		5,557
Add difference in the value of stock		68,441
Balance in favour of the Department...		62,884

In calculating the difference in stock, the book valuation, as shown in 1871, has been accepted, although it is known that several items were shown at much too high a rate. In calculating the closing balance on the 31st March 1882, heavy deductions for contingencies have been made, so that the value shown is fully represented by the actual stock. During the 11 years of working, the Department bought five steam engines, of which three are still in proper working order; there are also two vertical saw-frames and one circular saw-bench, saws, tools, &c.

78. It will be seen that the average profit per annum amounts to Rs. 5,717. In addition to this, the following points should be taken into consideration:—

(*a*) A large proportion of the timber worked up and brought into the market was bought from the Zamindar, who received during the 11 years the sum of Rs. 58,976.

(*b*) Produce has been brought into the market which, without the interference of Government, would not have been made available.

(*c*) According to the information supplied by the Conservator of Forests, the Chhattisgarh State Railway received material (sleepers) at lower rates than they paid in the open market, and the Forest Department should, on this account, be credited with an additional sum of Rs. 42,000.

(*d*) Last, but not least, a remarkable improvement has been effected in the condition of these forests. The quantity of timber removed is considerably below what they can yield, and the ground has throughout been covered with a dense young growth. It is not practicable at present to express this improvement in Rupees, but it certainly represents a very considerable sum.

On the whole, it may safely be said that the operations in the Ahiri forests have up to date been very satisfactory.

79. The difficulties of working the Ahiri forests are considerable. In the first place, the climate is very unhealty, so that the officers supervising the works are constantly liable to be laid up with fever and other diseases. Then, again, the forests are situated in the southernmost part of the Chanda District, and far away from the markets. The lines of export are *either* towards Madras in the south, *or* towards the Central Provinces in the north. Hitherto it has not been found a paying enterprise to send timber *viâ* the Wainganga and the Godavari to the Madras Coast; but it is probable that this line of export may be resorted to at some future date. So far the material has been taken to the Central Provinces and to Hyderabad. The following are the distances over which the timber has to be carried :—

	Miles.
Ahiri Forests to Warora, by road	103
Ditto ditto partly by road 40 miles, and partly by water *upstream* 92 miles ...	132
Ditto to Chhattisgarh Railway, by road 54 miles, by water *upstream* 130 miles	184

The only wonder, under these circumstances, is that the operations have esulted in any profit at all, instead of a heavy loss; and for this result Major Doveton, the Conservator of Forests, deserves great credit.

80. The acquisition of the Ahiri Forests will not only prove a source of irect and indirect benefit to the country and the people, but the measure is lso sure to be financially successful. At present the forests are worked very paringly, and it is not intended to extend operations for some time to come eyond the removal of the trees which the condition of the younger growth akes it advisable to extract. Should, however, large quantities of timber for he construction of Railways or for other works be required, then these forests an, without damage, yield a considerable outturn.

CHAPTER VII.—FINANCIAL RESULTS.

81. Before bringing this Report to a conclusion, it will be useful to review shortly the *financial results* of the Department. By arranging the Receipts and Charges in periods of three years, the following averages per year are obtained :—

Year.	Receipts.	Charges.	Surplus.	Proportion of Surplus to Receipts, in per cent.
	Rs.	Rs.	Rs.	Rs.
1864-65 to 1866-67	2,19,682	1,12,971	1,06,711	49
1867-68 to 1869-70	3,72,016	3,27,000	45,016	12
1870-71 to 1872-73	5,29,186	2,62,317	2,66,869	50
1873-74 to 1875-76	6,51,827	3,16,186	3,35,641	51
1876-77 to 1878-79	7,32,699	3,33,344	3,99,355	55
1879-80 to 1881-82	10,09,915	5,05,033	5,04,882	50

These data show that the financial results are in every way satisfactory. The Receipts, as well as the Surplus, have largely increased during the last 18 years, and a favourable proportion has been maintained between them. From what has been stated in Chapter II of this Report, it is evident that the Receipts from the State Forests must go on increasinig in the same proportion

as the Malguzari forests are reduced in area and quality, and as the population increases. The Department can, therefore, well afford to spend a considerable sum per annum on the protection and improvement of these valuable Government estates.

82. The *departmental timber operations* during the years 1877-78 to 1881-82 show the following results :—

		Rs.
Receipts	...	7,80,918
Charges	...	6,74,191
Surplus	Total ...	1,06,727
	Per year ...	21,345

83. The average annual expenditure, calculated for the last five years, on the *demarcation and improvement of the forests* is as follows :—

			Rs.
Communications and Buildings,	A. VII	...	4,818
Demarcation,	A. VIII*a*	...	971
Compensation for land and rights,	A. VIII*b*	...	172
Surveys and Working-Plans,	A. VIII*c*	...	865
Plantations,	A. VIII*d*	...	3,692
Protection from Fire,	A. VIII*e*	...	11,839
Other Works,	A. VIII*f*	...	7,075
	Total per year	...	29,432

84. The *Superior Staff* at present sanctioned for the Central Provinces consists of—

Conservator of Forests	...	1
Deputy and Assistant Conservators	...	14
Sub-Assistant Conservators	...	4
Total	...	19 Officers.

The *cost of the superior and subordinate staff* per annum stands now as follows :—

		Rs.
Superior Staff, average	...	1,15,560
Subordinate Staff—		
Permanent	...	55,332
Temporary, about	...	1,50,000
Total	...	3,20,892

or Rs. 16 per square mile of forest under the management of the Department.

It has been shown in Chapter III that a considerable increase in the number of Sub-Assistants and Rangers is required; but, as, at the same time, the temporary staff will be gradually reduced, it does not follow that the total expenditure on account of establishments should increase much for a number of years to come.

APPENDICES

APPENDIX A.

Area and Population of the Central Provinces, arranged according to Districts and Divisions.

No.	Names of Divisions and Districts.	Area, in square miles.	Population.		Assessed cultivated area, in square miles.	Assessed grazing lands, in square miles.	Area of Forests, in square miles.							Proportion,		
			Total.	Per square mile.			Private Forests.			Government Forests.				Between area of Government Forests and total area, in per cent.	Between area of unculturable waste in private estates and total area, in per cent.	Total.
							Culturable.	Unculturable.	Total.	First class reserves.	Second class reserves.	Unreserved forests.	Total.			
	Nagpur Division.															
1	Nagpur	3,786	697,356	184	1,650	143	385	617	1,002	112	390	8	510	13	16	29
2	Bhandara	3,922	683,779	174	1,230	48	1,046	980	2,026	...	551	...	551	14	25	39
3	Chanda	10,785	649,146	60	1,115	489	4,264	1,658	5,922	391	2,977	...	3,368	31	15	46
4	Wardha	2,401	387,221	161	1,333	32	361	314	675	...	200	...	200	8	13	21
5	Balaghat	3,146	340,554	108	624	49	281	316	597	163	950	61	1,174	37	10	47
		24,040	2,758,056	115	5,952	761	6,337	3,885	10,222	666	5,068	69	5,803	24	16	40
	Jubbulpore Division.															
6	Jubbulpore	3,918	687,233	175	1,353	7	827	775	1,602	42	329	...	371	9	20	29
7	Saugor	4,005	564,950	141	1,409	356	441	480	921	66	742	...	808	20	12	32
8	Damoh	2,799	312,957	112	756	277	202	493	695	10	836	22	868	31	18	49
9	Seoni	3,247	334,733	103	829	...	522	562	1,084	231	554	196	981	30	17	47
10	Mandla	4,719	301,760	64	554	...	1,128	574	1,702	218	2,188	...	2,406	51	12	63
		18,688	2,201,633	118	4,901	640	3,120	2,884	6,004	567	4,649	218	5,434	29	15	44
	Nerbudda Division.															
11	Betul	3,905	304,905	78	992	278	821	393	1,214	425	852	...	1,277	33	10	43
12	Chhindwara	3,915	372,899	95	959	447	360	423	783	43	641	2	686	18	11	29
13	Hoshangabad ...	4,437	488,787	110	1,479	13	378	400	778	583	1,189	...	1,772	40	9	49
14	Narsinghpur	1,916	365,173	191	952	...	190	518	708	...	193	...	193	10	27	37
15	Nimar	3,340	231,341	69	572	...	140	236	376	295	1,509	...	1,804	54	7	61
		17,513	1,763,105	101	4,954	738	1,889	1,970	3,859	1,346	4,384	2	5,732	33	11	44
	Chhattisgarh Division.															
16	Raipur	11,885	1,405,171	118	3,495	...	4,374	2,536	6,910	6	1,377	...	1,383	12	21	33
17	Sambalpur	4,521	693,499	153	1,122	...	890	1,700	2,590	...	715	...	715	16	38	54
18	Bilaspur	7,798	1,017,327	131	1,671	798	1,845	3,507	5,352	3	649	...	652	8	45	53
		24,204	3,115,997	129	6,288	798	7,109	7,743	14,852	9	2,741	...	2,750	11	32	43
	Total British Territory ...	84,445	9,838,791	117	22,095	2,937	18,455	16,482	34,937	2,588	16,842	289	19,719	23	20	43
	Feudatory States ...	28,834	1,709,720	59	...	...	...	...	...	...	...	...	...	.....	.....	...
	Grand Total ...	113,279	11,548,511	102	...	...	...	...	...	...	...	...	...	.....	.....	...

APPENDIX B.

Detailed description of the Bori, Moharli, and Ahiri Reserves; by D. Brandis, Ph. D., F.R.S., C.I.E., late Inspector General of Forests to the Government of India.*

1.—THE BORI RESERVE.†

Area and Boundaries.

1. The area of the Bori Reserve is 37½‡ square miles, and it is situated wholly in the District of Hoshangabad.

On the north it is bounded by the escarpment of the sandstone range, which extends westward from the Pachmarhi plateau. To the west it is bounded by the Son Budra River, and to the south and east by a line cleared to a width of 60 feet.

Maps.

2. The Bori Forest, together with the surrounding country, was surveyed between 1867 and 1869 by the Topographical Survey, the published maps being on the scale of 1 inch to the mile. There is also a manuscript map of this reserve, on the scale of 4 inches to the mile, prepared by the Forest Department in the year 1871, but it is not considered sufficiently accurate to be of much use.

Rock and Soil.

3. The rock is chiefly sandstone and trap. It is due to the peculiar combination of these two descriptions of rock that the soil is rich, and that it is in most places exceedingly favourable for forest growth. In the valley of the Bori River, banks consisting of the grey shale of the Damuda formation are found, but we have no reason to believe that this rock, which extends over large areas in the basin of the Tawa River outside the reserve, is of any importance as regards the soil of the Bori Forest.

The sandstone forms the range which bounds the forest on the north, as well as several ridges and plateaux in the forest. The trap is found in isolated masses at the foot of the sandstone range, and there is a considerable extent of flat-topped hills consisting of this rock on both sides of the Bori River.

Mr. Medlicott's map, appended to the 2nd volume of the Memoirs of the Geological Survey, gives a fairly correct representation of the distribution of these three formations in the Bori Forest. The map, however, is on too small a scale, and, being a sketch-map only, is not in all respects accurate. Eventually, when a detailed descriptive account of each compartment is prepared, it will be well to make a detailed examination of the area and to enter the limits of the different descriptions of rock on a large scale map.

The soil which overlies the sandstone is here as elsewhere light, and apt to be very dry, while the soil which overlies the trap rock is a stiff loam. But the soils which are the result of the decomposition of these two rocks are mixed in most parts of this forest, and the result is extremely favourable for forest growth. Speaking broadly, it may be said that the forest growth is best, and particularly that teak is most abundant, where trap is the chief rock, and that on the sandstone plateaux, where the strata are nearly horizontal and lie close under the surface, the forest is thin and poor.

Provisional division of Forest into Blocks.

4. As a purely provisional arrangement, the forest may be divided into 12 blocks or sub-divisions, which are separated from each other by the Bori River and its principal feeders, the main road which runs through the entire length of the reserve from east to west, and a number of block lines cut in 1870 and 1871, which run in a northerly direction from the main road to the foot of the sandstone range. The sub-divisions thus formed are of unequal size, and not uniform as regards the soil and character of forest vegetation, but they will be found convenient as a provisional arrangement until a more perfect sub-division can be made.

Blocks north of the main road.

5. Blocks Nos. 1 to 7 are situated between the main road and the escarpment which bounds the forest on the north side. They are separated from each other by 6 sub-division lines leading from the main road to the foot of the cliffs.

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* As indicated in paragraph 1 of the foregoing Report, Mr. Brandis visited the Central Provinces in the winter of 1876-77, when he drew up descriptions of a number of forests. Of these, only those referring to the Bori, Moharli, and Ahiri Forests were in a sufficiently complete state to admit of their being published. I have, on the whole, given the descriptions as I found them, and the few alterations and additions made by me have been explained in foot notes.

In reading these descriptions, it should be remembered that they were drawn up in 1876-77; that Mr. Brandis had no opportunity of working them up finally before they went to press; and that he would, doubtless, have made considerable alterations had he published them himself.—W. S.

† This description refers only to the original Bori Forest.—W. S.

‡ 24½ square miles were added in 1879-80, so that the total area is now 62 square miles.—W. S.

Block 1, which may be called after the deserted village of Jholi, extends from the Son Budra River to the first line. In a great portion of this block the soil is poor and dry; there were formerly numerous extensive blanks which are however steadily filling up.

Blocks 2, 3, and 4 comprise a tract of hilly country between the foot of the cliffs and the road, the greater part of which is stocked with most valuable forest. Immediately under the cliffs the soil is a mass of sandstone boulders, and consequently the forest here is dry and stunted. Teak, however, is not wanting, though on this soil it probably will not attain any large size. Lower down trap alternates with sandstone, and the forest is well stocked with a promising crop containing a large proportion of teak. Teak is here chiefly associated with bamboo, the stems of which attain a length of from 40 to 50 feet, with a girth of from 9 to 10 inches. In most cases the poles of teak have overtopped the bamboo, and have attained a height of 60 feet and upwards. Here and there groups of poles of Lendya, Saj, and other trees are found, but the chief constituents of this part of the forest at present are teak and bamboos.

Blocks 5, 6, and 7 are a continuation of blocks 1 to 4, and comprise the ground between the base of the cliffs and the main road which follows the course of the Eklama River. The line which divides blocks 4 and 5 may fitly be called the Belkhander line, as the foot-path which leads to the top of the cliffs at the foot of the Belkhander peak branches off from it. The eastern boundary of block No. 7 is the boundary of the reserve. In these blocks the proportion of teak in the forest diminishes eastward.

Blocks south of the main road.

6. The sub-divisions south of the main road are larger in area, and will eventually doubtless be further sub-divided. Block 8 we have called after the deserted village of Churni, the site of which was on the plateau which occupies the southern part of this block. It is bounded on the west by the Bori River, on the north by the main road, and on the south and east by the boundary of the reserve. The slopes towards the Bori River contain large extents of bamboo forests, the results of comparatively recent Bewa clearings, with young teak. Towards the east the proportion of teak diminishes, and in the eastern corner of this block, where the road passes out towards Rorighat, the forest is moist and almost evergreen.

Block No. 9 is comprised between the Bori River on the north and east, the Gogri Nadi on the west, and the reserve boundary on the south. This may be called the Majhora Block, from the deserted village of that name. The eastern part of this block is occupied by a long and narrow sandstone plateau, which skirts the river from Bori to the site of Majhora village. On the plateau the strata are close to the surface, the soil is dry, and the forest poor and open in consequence. But on the slopes, as well as in the ravines and valleys which run from it chiefly towards the west, soil and forest are excellent. The proportion of teak is considerable, but the poles are younger and not as tall as those in blocks 3, 4, and 5. The site of the village and former fields in the vicinity, to the extent of a few hundred acres, has not yet become stocked with forest, but is mostly covered with grass, with groups of Ber (*Zizyphus Jujuba*). In many places, however, young growth of teak and other kinds is shewing its head above the grass.

Block No. 10, or Lama Block, is called after the deserted village of that name. It is bounded on the east by the Son Budra and on the three other sides by the south boundary of the reserve and the Gogri and Bori Rivers. Around the site of Lama village the forest is open and stunted, with the exception of some groups of fine teak poles, and generally the western part of this block is stocked with inferior forest, but in the eastern and central part the growth is good and the proportion of teak fair.

Blocks between main road and Bori River.

7. The remaining two blocks, 11 and 12, consist of the intricate mass of hills and valleys which are comprised between the main road and the Bori River. This large area may provisionally be divided by the path which leads from Jholi to the old deserted site of Pepreah, block 11 being the eastern, and 12 the western part. Block 11 is the best portion of the forest; trap is the chief rock, and the soil throughout is very favourable for the growth of teak. The tops of the ridges were formerly blank or very open, with a few scattered trees, but nearly the whole of these have now become stocked with young forest in which teak predominates, the latter being more numerous than the trees of any of the other kinds. There is, however, a marked difference on these hills between the slopes with a northerly, and those with a southerly, aspect. On the former the proportion of teak is much less, and bamboo and other trees have the upper hand, while on the slopes with a southerly aspect the forest is what may fairly be called a teak forest, in which this tree has got the upper hand of bamboo and all other trees in the struggle for existence. This difference of slopes with different aspects is, however, much less marked on slopes with a gentle gradient, for on such there is not, as a rule, any considerable difference in the proportion of teak. The forest in block No. 12, which adjoins the Son Budra River, is less good. In its western part there are hollows, with stiff soil, which are very damp during the rains.

Principal Trees.—Teak.

8. The chief product of this forest is teak. The first time that an attempt was made to extract timber was about 1861. A large number of trees were girdled and some timber was exported, but the greater portion was left standing, and subsequently a portion of this timber was cut and exported by the Forest Department between 1865 and 1870. At the same time

a small number of unsound green trees was cut. Previous to these operations, teak was cut and burnt for Bewa cultivation, but not for export, and it is due to the difficulty of export and the remote situation of the forest that so much teak still remains in it.

The largest tree felled on record was 9 feet in girth, but this, like most other large trees, was hollow, the consequence of fires in Bewa and of old age. The logs which were obtained from the forest were generally not more than 20 feet in length, and it has been maintained that the trees do not attain a greater length in Bori. This, however, is certainly a mistake. Poles of 60 to 80 feet, with a girth of only 3 feet, are now common in this forest, and there seems no reason to doubt that these trees will attain a girth of 6 feet and a height considerably exceeding 100 feet. One pole, which we measured in block No. 11 in the vicinity of the road, was 83 feet in height, and 3 feet 3 inches in girth. The large trees which were cut between 1861 and 1870 had either been mutilated in Bewa clearings, or had grown in places unsuitable for such cultivation, especially on exposed ridges or rocky ground.

It must not, however, be supposed that a teak tree will attain the height of 100 feet in all parts of the forest. Between the sandstone boulders at the foot of the escarpment we found numerous trees, apparently of mature age, with a short bole not exceeding 20 to 30 feet. Such trees will probably never attain a greater height, nor is their girth likely to exceed 4 feet; but in more favourable localities there seems no reason to doubt that this forest will produce logs 40 feet long, with a diameter of 2 feet.

Rate of growth.

9. Regarding the rate of growth no data are available, save those which the plantations afford and which we will mention further on. A number of trees in the vicinity of the main road were marked and measured every year from 1865 to 1868, but unfortunately these measurements were discontinued; the records of the measurements are not available, and the trees can no longer be identified. As soon as the first cuttings of teak are made, the greatest attention should be paid to counting the annual rings of the stumps, in order to obtain reliable data regarding the rate of growth. It is probable that the rings in this forest, with its severe cold season, will be found easily distinguishable.

Considering that the latitude of this forest is 22°20′, it cannot be expected that the teak in Bori should grow as rapidly as in forests situated further south; but, for its latitude, it is probable that the rate of growth will be found to be comparatively favourable. Compared with the surrounding country, Bori is exceedingly moist, and, though no data are available regarding the atmospheric moisture and rain-fall in this locality, yet it is known that heavy dews are common as late as March. Its situation below the Pachmarhi Hills, which have a rain-fall of 70 inches, makes it probable that the rain-fall in Bori is considerable. Since fire protection has taken effect, teak retains its leaves in this forest until well into the hot season.

Enemies of Teak.

10. The chief enemy of teak in Bori is the severe night frost, which generally takes place in December, January, and February. Numerous seedlings, which spring up in open glades in the vicinity of the river or on low ground, are cut down annually by the frost to the root, but always shoot up again, and not a few of them have now attained a height which protects them against the cold. A caterpillar has done great damage this year in the forest west of the Son Budra River outside the reserve. Many trees had been stripped of their leaves, and had by the time of our visit become covered with fresh foliage. Very little of this damage, however, was noticed in the fire-protected reserve.

Bamboo.

11. Next in importance to teak is bamboo, which is the small kind *Dendrocalamus strictus*. I spent several days in this forest in April 1869, and one of the principal points which struck me on my present visit, after a lapse of nearly 8 years, is that the bamboo in Bori has considerably diminished in quantity since that time. There has been no general flowering of this bamboo in Bori since 1869, but scattered clumps flower, seed, and die every year; and this year we noticed, as is usual in this species, a number of clumps which had died a few years ago, and others that were in full flower. Here and there we noticed patches covered with young bamboo, but they were scarce, and it was evident that, in most cases, when a clump had died the ground was taken up by seedlings and coppice-shoots of teak and other kinds. In fact the forest has since 1869 assumed more the character of a tree forest, and less that of a bamboo forest. With very rare exceptions of teak saplings struggling under the shade of bamboos, teak has (so it appears to me) nothing to fear from the bamboo in Bori. Nevertheless, if ever it should be possible to export bamboos profitably, this would give more room to teak, and would be so far advantageous. Speaking broadly, it appears to me that the company of bamboo is highly beneficial to teak in this forest.

Tinnas.

12. Next to teak, Tinnas *(Ougeinia dalbergioides)* is probably the most common tree. Both in poor shallow soil on the top of ridges and on deep alluvial soil in ravines and along streams did we find numerous thickets and pole forests, consisting chiefly of saplings and small poles of Tinnas; nor are trees of larger size uncommon. The largest we measured had a bole 20 feet long and 3 feet 4 inches in girth. If the means could be found to bring

Tinnas to market at sufficiently low rates, a considerable revenue might be made from this source.

Other Trees.

13. In point of numbers, Saj probably stands next to Tinnas, and in some places it is the dominant tree. Large trees, however, are not very plentiful at present. Next to Saj stands Tendu *(Diospyros)*, Lendya *(Lagerströmia)*, and Dhaura *(Anogeissus)*, and after them probably follows, as regards numbers, Bijasal, large specimens of which are found chiefly on the tops of the hills. Seedlings of this tree are abundant between the grass in many blanks, and, considering the value of the wood, the growth of this tree should be encouraged. On village sites and on open grassy plains Palas *(Butea)* and Ber *(Zizyphus)* are common. Shisham *(Dalbergia latifolia)* of large size (up to 5 feet in girth) is rare. Young trees are found here and there, chiefly in the eastern part of the forest. Kosum *(Schleichera)* trees are not uncommon in certain localities, but all attempts at the artificial propagation of lac on this tree have as yet failed. Here and there patches, with a large proportion of Bael, are found, forming small forests of poles or saplings mixed with teak.

Export of Timber and Bamboos.

14. Hitherto teak has been the only product exported from this forest, and the export has been entirely by land; some of the timber was carted to Utam Ghat, distant from Bori 24 miles, and from thence floated to Hoshangabad. There is no difficulty about the road, but carriage is expensive, as it has to be obtained from the open country in the Nerbudda Valley, and on this account it has not yet been possible to make the export of bamboos by this route remunerative. It is obviously of great importance to open out new sources of revenue from this forest by improving the means of water carriage, and thus diminishing the cost. By water the shortest way would be by the Son Budra and Denwa Rivers, but the opening up of the Son Budra River for floating is at present considered impracticable. The gorge which it enters below the village of Jholi is four miles long at least, and the stream is said to be completely blocked up with boulders, and, moreover, landslips from both sides are said to be common. The Denwa River below its junction with the Son Budra River is also a difficult stream for floating. Timber cannot be caught in high floods during the rains, and in autumn there is not sufficient water for floating.

Plan for opening the Malni River.

15. Under these circumstances, a plan framed by Captain Doveton seems the best that can be devised, and it consists in this—to open the Malni River, which joins the Pawa River below Chanagarh, from near Malni village, and eventually to make a good road or tramway from the Son Budra River to Malni, a distance of about 10 miles. The Pawa River admits of floating from a point below its junction with the Machna, and bamboos might be brought down the Pawa in autumn, after having been floated during the monsoon down the Malni River to its junction with the Pawa. On the success of this undertaking will entirely depend the present revenue to be derived from this forest. As a commencement, we only contemplate the export of bamboos, and possibly of Saj, Dhaura, and Lendya. If it were possible, one of the most beneficial measures would be the cutting out in the well-stocked parts of the forest of a large number of old trees with spreading branches, with the view of giving the stock standing on the ground a more uniform character.

I am informed that a considerable number of mature teak trees are found scattered in the forest, but for the present they must, as a rule, be left standing, in order to increase the production of young growth. When the ground in their vicinity is sufficiently stocked with poles, saplings, and young growth of teak, they may be removed, and here and there some of the larger poles may be thinned out. But it would be premature at present to cut teak on a large scale.

Improvement.

16. The chief aim in the management of this forest must be to increase the proportion of teak in it, and next to teak to further the growth of Tinnas and Bijasal. Considering the large bamboo resources at the head of the rivers Pawa and Machna which are at the disposal of Government, it does not seem likely that the export of bamboos from the Bori Forest will be sufficiently remunerative to make the protection of this article the chief point to be looked to, although it will be the first produce from which a considerable revenue can be expected, if a cheap mode of transit is established.

There is no risk, in my opinion, that we might overdo the production of teak in this forest. Compared with each kind separately, teak is the dominating tree, but it is much less plentiful than the other kinds taken together. And though soil and other circumstances are most favourable to its spread, there is no chance of this forest ever becoming a pure teak forest. The blanks are filling up rapidly by self-sown seed and by the growth of coppice-shoots, but only a portion of these are teak, and in places the proportion of teak is very small.

Cultivation of Teak necessary.

17. The procedure which is here indicated by circumstances is to stock the blanks with as large a proportion of teak as possible. We propose that one block should be selected for this operation, and that, beginning at one end, all blanks in this block be sown up on good soil with teak alone, and on poor soil with teak mixed with Bijasal and Tinnas. Indeed, there would be no harm in sowing Tinnas mixed with teak throughout, for it is a slow-growing tree, which would form a most useful underwood or lower story of small poles under a high forest of teak. We have selected for this purpose the Majhora Block, and suggest

that a commencement should be made in endeavouring to stock the open ground around Majhora.

Broadcast sowing.

18. Captain Doveton is in favour of trying broadcast sowings on a large scale. This plan should accordingly be tried in one portion of the area selected to be operated upon. The only expense of this system will be the collection and scattering of seed; it requires neither skill nor heavy outlay, and can therefore at once be carried out on a large scale. If it succeeds, it will be specially suitable for Bori, where the difficulty of procuring labour is considerable. Under exceptionally favourable circumstances, I admit that this system may succeed; but, as a rule, I fear that the failures will be many, and that a more elaborate system of cultivation will in the end prove to be more economical.

Sowing in lines.

19. I would, therefore, suggest that, by way of experiment, simultaneously with the broadcast sowings, two or three small but well-defined areas be planted up in accordance with the following plan:—narrow straight lines should be cleared through the grass early in the dry season, and along the lines patches about a foot square or somewhat less should be dug up at distances not more than three feet apart, except where trees, rocks, or other objects intervene. I am told that the ravages of rats in Bori are likely to be considerable, and that, if sowings were made in regular lines, as here suggested, rats would burrow along the lines and destroy the sowings. In order to guard against this, the patches might be so arranged that they should not be on the line itself, but contiguous to it, alternate patches being on the same side and adjoining patches on different sides of the line. I am, however, inclined to think that the damage likely to be done by rats to sowings in lines has been over-estimated. The patches should be sown in the manner suggested above with teak, Tinnas, and Bijasal, the seed being lightly covered and cut-grass or branches being spread over the patches. I am decidedly in favour of sowing teak seed in spring, and not in August as proposed by Captain Doveton. I am aware that in these provinces a great portion of the seed does not germinate the same year, but this I consider is no disadvantage. It will probably be necessary to clear these lines once a year for two or three years running, after which the plants will take care of themselves.

This arrangement of the plots or patches in lines facilitates control and the filling up of blanks, and the cost of the operation per acre may be diminished by allowing a considerable distance between the lines. In places where the natural young growth on the ground is considerable, these lines might be 20 or even 30 feet apart, while in blanks without any natural growth the distances might be less; but I would never in this forest have the lines nearer than 15 feet. An accurate and detailed account should be kept of the amount expended on the areas under each system, as well as regarding the progress of the experiments generally.

By way of experiment, Blackwood—Shisham (*Dalbergia latifolia*)—should be tried in addition to the kinds named.

Plantations made in the forest.

20. It is here the place to state the experience gained in the cultivation of teak in this forest. In 1868 two teak plantations were established near Bori, one on the right bank of the river and the other on an open grassy plateau, the site of an old Bewa, on the ridge above it. In both places teak was planted in 1868 and 1869. Nurseries were established near the river, and the seedlings transplanted during the first rains.

The ground selected on the ridge is low in the centre, and higher along the edge all round. On the low ground the plants have been kept down by frost, and are on the average barely 3 feet high, while, on the higher ground near the edge of the standing forest, they are on an everage 20 to 25 feet high, with a girth of from 7 to 11 inches.

The plants were planted 6 feet apart both ways, and at this distance they stand near the edge, while in the centre there are numerous blanks. The shelter which the surrounding forest has afforded against the frost is doubtless the chief cause of their better growth here. The area here planted is about 3 acres.

A much larger area has been planted on the low ground near the river, but with much less success. A proportion of the trees has here been killed by the frost, and the remainder are cut down every year to the root, but send up shoots annually, which are gradually increasing in vigour and will probably eventually go ahead. In the vicinity of a group of trees near the river the plants had attained a height of from 20 to 25 feet, with a girth of from 7 to 8 inches. The experiment here made in the vicinity of the river is interesting as an experiment, but we do not propose that such localities should be selected for cultivating teak on a large scale, unless, indeed, another species of tree, which is not affected by frost, is raised in the first instance to afford the needful shelter to teak.

Formation of final compartments.

21. After the export lines from this forest have been improved, and after experience has been gained regarding the comparative importance of different kinds of produce, and after the best system for improving the forest by cultivation has been determined, it will be time to draw up a detailed descriptive account of each portion of this forest, and at the same time to divide it more completely than can be done at present into blocks and compartments. I do not advocate that this should be done at present, for the lines separating

blocks and compartments must be so laid as to serve for the export of produce, and in this respect, as well as in the treatment of the forest generally, our experience is as yet too short to enable us to take useful action beyond what has been suggested. After this has been accomplished, and the forest has been completely divided into blocks and compartments, a more detailed topographical survey may become necessary, but this also is not required at present.

22. The Bori Forest has been protected from fire since the hot season of 1864, and very few accidents have happened. The only source of danger has been the open spaces covered with tall grass, and as these are getting gradually stocked with young growth of coppice-shoots and saplings, the danger from fire is diminishing every year. The beneficial effect which this protection has had on the general character of the forest is incalculable, and the teak has profited by this protection fully to the same degree as other trees, if not to a larger degree. **Fire protection.**

23. South of the boundary line there is a certain extent of unreserved Government Forest, but we do not at present propose any extension in that direction. West of the Son Budra River, however, the land at the foot of the range of sandstone hills which forms the continuation of the Pachmarhi Hills is, with the exception of a small area near Kankri, all unreserved forest, which extends nearly to the Pawa River. **Proposed extension.**

Between the Son Budra and Kankri Rivers the rock is sandstone and trap, and the soil is similar to and as good as that in parts of Bori. The character of the forest is also similar, consisting of fine bamboos, with a large proportion of well-grown teak; but, as the forest has not been protected from fire, the blanks are larger and more numerous.

Between Kankri and Chuna the forest is less valuable, bamboos are scanty, and there is scarcely any teak. The rock is chiefly sandstone, and Bijasal is not uncommon. Between the Sohagpur and Shahpur roads and the Pawa River teak is more plentiful, although at present only of small size.

How much of this stretch of country between the Son Budra and Pawa Rivers should eventually be reserved, cannot here be discussed; but so much appears clear that the forest between the Son Budra River and Kankri should be included, as a great portion is quite as good as the best portions of Bori. The reserve should, however, be extended as far as possible in the direction of Malni village, as this will make it possible to maintain control over the line of road from the Son Budra River to Malni.*

—THE MOHARLI RESERVE.

The area of the Moharli Reserve is 359 square miles, and it is situated in the three tahsils of the Chanda District—Mul, Brahmapuri, and Warora. The western portion was demarcated in 1871 and 1872, and the eastern part was added in 1876. The boundary has been marked out, and a line 15 feet wide has been cleared all round. Where the boundary adjoins Malguzari land, there are the usual large upright stones, but no special boundary marks have been erected. The Erai Nadi forms the boundary on the west for about 5 miles, while on the south the Andhari Nadi for about 9 miles limits the reserve. On the west side the boundary marches almost entirely with Malguzari lands, while on the other sides a large portion of the adjoining land is unreserved forest. Enclosed within the reserve are 19 small villages, of which 11 are Malguzari and 8 Khalsa.

2. A map on the scale of 1 mile = 1 inch, prepared by the Revenue Survey, is available, which will answer all purposes for a considerable time to come. The map should be completed by entering all existing roads, the names of hills, streams, springs, deserted villages, and other localities not entered at present. **Maps.**

3. The western part of the reserve is occupied by a series of ridges forming almost a continuous range, commencing at Moharli and extending beyond Kotran; to the west these hills have abrupt rocky faces, elevated a few hundred feet above the valley of the Erai Nala; towards the east their slope is gentle towards the valley of the Andhari. The highest point is Amdagarh, with an elevation of 1,220 feet. The tops of these ridges are generally flat, and to the north is a plateau about 3 miles broad, which extends a considerable distance beyond the reserve. On the east side of the reserve, from the Mul River to its southernmost point, is another range [known as the Mul Hills], which chiefly consists of a number of high and broad plateaux. **Topography.**

4. The north-western part of the reserve is drained by several tributaries of the Erai Nadi, the largest of which is the stream which takes its rise in the Taroba tank. A small area in the east is drained by the head-waters of one of the feeders of the Mul River, but the centre and chief portion of the reserve is drained by the Andhari Nadi, the two chief branches of which are the Purana Andhari, rising above and running through the Jamnee tank, and the Naya Andhari, which runs through the Karwa tank. **Principal streams.**

* Since then an area of 24½ square miles has been added to the reserve.—W. S.

It will be convenient to consider the reserve, with regard to the configuration of the ground, as consisting of the ranges in the west and the east, with their plateaux and the valleys between them, and the basin of the Andhari River and its feeders, which forms the most important part.

Blocks.

5. For the present a final sub-division of the reserve into blocks is not yet feasible; but for the purposes of this Report, and until a more complete sub-division takes place, the following designations of the chief sub-divisions have been agreed upon :—

1*st*, *Taroba Block*, comprising the north-west corner, west of the main road from Hulara to Khattora;

2*nd*, *Palusgaon Block*, bounded on the east by the Naya Andhari, and a line drawn northwards from Karwa, and in the south by the main road from Moharli to Botejhiree;

3*rd*, *Goverdhan Block*, bounded on the east by the Andhari River and the lower course of the Naya Andhari, to the north by the road already mentioned from Moharli to Botejhiree, to the south and the west by the exterior boundary of the reserve; and

4*th*, *Kolsah Block*, comprising the eastern part of the reserve, east of the Andhari, Naya Andhari, and a line to the north of Karwa.

Rock and Soil.

6. The rock is grit and sandstone, and the soil is chiefly formed by the disintegration of these rocks. In places there are large beds of laterite. Hard grit is on the surface both in the eastern and western hills.

The soil in the greater part of the reserve is sandy, and there are large extents of high ground between the feeders of the Andhari Nala and round the head-waters of the Uparsa Nala, where there is a deep layer of very light sandy loam, occupying the high ground, while tanks, streams, and their feeders are skirted by belts (varying in breadth) of a more binding soil, which in places is likely to crack and to produce holes and crevasses. The soil on the broken ground is in places a stiff clay containing kunker nodules. Wherever laterite is found, it is overlaid by a stiff red soil.

Water-supply.

7. There are no permanent running streams in the reserve, but the Erai and the two branches of the Andhari, and the Dhoonee Nala, have a succession of large pools, which contain water throughout the year.

Numerous tanks have been formed by bunding, but of these only the Taroba, Karwa, and Jamnee tanks contain water throughout the year. Upon the whole the water-supply in the reserve is exceedingly scanty, and the only permanent springs are the following—two in the Kotran Nala, one in the Bhanuskandi Nala, one near Katejhiree, one by Chichgat, one at Khattora, besides five or six springs in the eastern range of hills; but outside the reserve in the hills there is a much larger number of springs. It is obvious that this is a scanty water-supply for such a large area, and it remains to be seen whether protection from fire will increase the supply.

Vegetation.

8. Four principal types of forest vegetation are found in this reserve, which may be designated as follows :—

1st, Bijasal Forest; 2nd, Ain and Rohni Forest; 3rd, Bamboo Forest; 4th, Open Forest, with a large proportion of Salai and Gabdi.

Bijasal Forest.

Bijasal, locally called Dhorbeula, is found in varying proportions nearly all over the forest wherever the soil is a light sandy loam, and from what I saw I was strongly impressed with the great facility with which this tree spreads itself by means of its abundant and light seed. Wherever there are a few seed-bearing trees, the proportion of seedlings is surprisingly large, and all are agreed that this tree has a good chance of spreading largely on suitable soil wherever the forest is protected from fire. But, though eventually the reserve will probably have much more the character of a Bijasal forest than at present, those localities which are covered with forest of the Bijasal type are at present of limited extent.

Goverdhan Block.

9. The most extensive of the Bijasal tracts is the Goverdhan Block, extending from the main road, Moharli to Chanda, to near the Andhari, and measuring 6,355 acres. This block occupies the high ground between several tributaries of the Erai and the Andhari. With the exception of a few places where the sandstone crops out, and the forest is poor and stunted, the soil is a deep and sandy loam. The ground slopes gently to all sides, but is not cut up by ravines. A careful and very useful survey was made in 1874, 1875, and 1876 by Mr. Dobbs, the general results of part of which are recorded in paragraph 44 of the Annual Report of 1874-75; but it will be useful here to state the results of these surveys somewhat more in detail. The forest was classified, according to the proportion of Bijasal, into 3 classes—the first class, where this tree predominates, being designated as 0·5, meaning that of 100 trees above one foot in girth one-half or nearly one-half were Bijasal; the second, in which Bijasal is less frequent, was designated as 0·4; and the third class, where Bijasal was scattered, was designated as 0·3. In addition to these classes, another class was formed, containing the area without Bijasal, in which the soil was unsuitable, and it was designated as 0·1.

The whole area was divided into 66 compartments, and in 11 of these compartments an acre was taken as a sample, and on it all trees above one foot in girth were counted. The result of these countings has been as follows :—

Number of Compartment.	Number of Trees above one foot in girth on one acre.		Chief Trees of other kinds.
	Bijasal.	All kinds.	
2	86	138	Tendu 21, Dhaura 19.
6	39	100	Dhaura 33, Kâri 10, Tendu 8.
11	34	81	Dhaura 16, Moi 12, Tendu 10.
23	70	144	Goti 12, Moi 8, Teak 8, Dhaura 7, Kâri 7, Achar 7.
33	66	132	Dhaura 15, Achar 14, Kâri 10.
3	14	42	Tendu 11, Dhaura 5, Súrea 4.
4	7	35	Dhaura 8, Tendu 6, Súrea 4, Kâri 4.
22	13	139	Gogar 18, Súrea 12, Teak 8, Dhaura 8, Goti 8.
29	18	136	Dhaura 24, Bhira 10, Achar 7.
32	15	143	Bhira 24, Garari 17, Achar 12, Gungal 11, Kâri 11.
17	16	111	Súrea 13, Goti 12, Achar 11, Gungal 10.

Bamboo and other trees.

10. Over a large area in this Bijasal block, thickets of Bamboo are found, and the small number of trees recorded in compartments 3, 4, and 11 indicates that the forest in these sample areas chiefly consisted of Bamboos, though this is not expressly stated, and there were doubtless Bamboos in some of the other sample areas. This explains the small number of trees exceeding 12 inches in girth counted in these surveys. In pure tree forest, without Bamboo, the total number of trees was found to be between 132 and 144, of which in the best Bijasal localities one-half is Bijasal. Next to Bijasal, the most common trees are Dhaura and Tendu. There is also a considerable proportion of Achar, Kâri, and Súrea, and, in places of Bhira, Garari, and Gungal.

Young growth.

11. Saplings and seedlings are irregularly distributed. The Goverdhan Block has been protected from fire during the hot seasons of 1874, 1875, and 1876, and the beneficial effect of this protection is manifest in the young thickets consisting of Kâri, which is exceedingly common, and in places of Bhira, mixed with saplings and seedlings of Surea and Bijasal. From what I saw, and from what has been observed by others, there seems no doubt that Bijasal seedlings do not generally come up under shade, but that the tree requires a great deal of light. Under Bamboos no seedlings of this species were found, and the largest number were noted wherever there were blanks in the forest. The Bijasal had freely seeded during the year of my visit, and the tree was conspicuous for its green fruit: it did not seed in 1875 or in 1876.

Other Bijasal blocks.

12. Besides the block here roughly described, there are many tracts of similar character as regards soil and forest growth. The chief of these is east of the Andhari River, extending eastward to the hills and entering into the valleys, and northward to Trodee; tracts of smaller extent are found to the south of Moharli up to the Erai River, and north-west up to Daboree village. The last named tract is remarkable on account of the large proportion of tall and well-shaped Salai trees. There is also a considerable number of Bijasal trees on both sides of the road from Jamnee to Kulara.

Ain and Rohni Forest.

13. The second type here designated as Ain and Rohni forest is chiefly found on the belts of low ground which, as already mentioned, skirt the chief streams and their feeders. These stretches of comparatively low ground surround the Bijasal tracts everywhere, and the change in the character of the forest is frequently very sudden. Surea, Bijasal, Dhaura, and Kâri suddenly disappear; Ain, which is scarce on the high ground, is the principal tree, and it is generally associated with Rohni, which is characteristic of this class of forest. Tendu is found both in the Bijasal tracts and on the low ground on the edge of the two types of forest. The character of the trees in this type of forest is almost invariably stunted, the stems being short and gnarled.

Bamboo Forest.

14. The third type has been designated as Bamboo forest, but it should be understood at the outset that Bamboo thickets are found, more or less, in all descriptions of forest in the reserve, least of all in the open forest of Ain and Rohni, where they are confined to the banks of streams and nalas. The Bamboo is of the common, small, kind (*Dendrocalamus strictus*), with the exception of a narrow fringe along the left bank of the Erai Nadi; here Kattang (*Bambusa arundinacea*) is found. The clumps are young, and about 20 feet high, and there seems good reason to believe that the flowering took place in 1869, at the same time that the Bamboos at Jubbulpore flowered. The *Dendrocalamus* flowered over the greater part of the reserve about 1869, and the ground is now covered with thickets in various stages of progress. As always happens in the case of this species, the flowering did not take place simultaneously all in one year, but in some places a year or two previous, and in others a year or two afterwards. On the Guttaipailee Nala, west of Daboree, and elsewhere, here and there, the old Bamboo is still standing; and chiefly along the nalas a considerable area of

mature clumps which have not yet flowered remain standing, and from these the present revenue is derived amounting in 1875-76 to Rs. 4,321,* corresponding to about 7 lakhs of Bamboos. Here and there we found clumps in flower, and a large extent of the Bamboo thickets had not separated into distinct clumps, while in other places the clumps had been completely formed. Throughout the forest the leaves of the Bamboo were dry at the time of our visit, with the exception of that on belts of rich and moist soil in valleys. We noticed this particularly in the valley of the Chikalwai, a feeder of the Erai; we also noticed that in the southern block, which has been protected from fire for three hot seasons, the Bamboo was somewhat less dry than in the adjoining forest, which had been burnt every year.

In moist places and along the banks of nalas, the Bamboo of this forest attains as good a size as in the Satpura range, but such good growth is exceptional, and the majority of Bamboos exported from the Moharli Reserve is much shorter and smaller than the Bamboos produced in the Satpura range. Their smaller size and the very early drying up of the leaves may doubtless be correctly ascribed to the dry sandy soil of the reserve.

Open Forest. 15. Regarding the open forest of Salai and Gabdi, which has been designated as the 4th type, not much need be said. On dry stony plateaux and on the flat tops of ridges throughout the reserve, the forest consists chiefly of small stunted trees of *Boswellia*, *Cochlospermum*, and *Diospyros*, with a variety of other trees, such as are found in similar forest all over the Central Provinces.

General remarks. 16. A few remarks should now be made regarding the vegetation of the reserve generally. There is a large proportion of large-sized trees of Dhaura, Ain, Tendu, Baherah, Mohwa, Moyen (*Odina Wodier*), Aonla, Semul, Salai, Kari, a new species of *Albizzia* with spreading branches and small flowers allied to *Albizzia odoratissima*, but perfectly distinct; both species of *Stereospermum*, particularly *Stereospermum chelonoides*, which attains a very large size in this forest. A number of specimens of *Anogeissus acuminata*, in girth up to 7 feet and with tall stems, are found along the Andhari River; a number of *Dillenia pentagyna*, up to 7 feet in girth and with tall stems, are found in the vicinity of the Erai, where it bounds the reserve. All these trees attain a large size, and it is a characteristic feature of this reserve that the stems of the trees here mentioned are drawn up to a great height and are mostly regular in shape. There are exceptions, but these are caused by the peculiar disposition of the tree; thus *Dalbergia paniculata* (Sindar) and *Dalbergia lanceolaria* have aways fluted stems, but attain a lage size with tall fairly straight stems in the Moharli Forest.

The prevalence of Mohwa trees of all ages and generally with tall stems is a remarkable feature of some parts of this forest, especially in the northern part of the reserve. In many cases the stems of these trees have been drawn up by Bamboos, but the soil has doubtless had a considerable influence in this respect.

Garari and other small trees. 17. A number of trees which are generally supposed to attain a moderate or small size only are in this forest found to attain a great height; of these the most remarkable are Garari (*Lebidieropsis orbicularis*) and Bhira (*Chloroxylon Swietenia*). With its dark coloured stems and its bright foliage, Garari is a striking and characteristic feature in this forest, in places attaining 4 feet in girth, with straight tall stems. It forms extensive masses of saplings and tall poles often nearly pure. For house-posts the wood is much prized, and this tree will doubtless yield a considerable revenue at an early date. The tree coppices well, and it will doubtless be an important source of fuel when the lines of export have been improved.

* The following table shews the revenue derived from Bamboos and articles made of Bamboos in the Moharli Reserve during the years 1873-74 to 1881-82 :—

Year.	Revenue derived from Bamboos, in Rupees.		
	Brought to depôt by Government agency.	Removed from the forests by purchasers.	Total
1873-74	.....	1,464	1,464
1874-75	.....	1,408	1,408
1875-76	.....	4,321	4,321
1876-77	.....	5,264	5,264
1877-78	478	11,199	11,677
1878-79	1,021	10,568	11,589
1879-80	862	10,585	11,447
1880-81	548	10,509	11,057
1881-82	45	12,422	12,467

Other trees which are generally of a small size, and which are common in this forest, are *Strychnos potatorum, Flacourtia,* and Gungal (*Cochlospermum gossypium*). All three attain an unusually great height, with straight stems; the *Strychnos* is common in places in the north-eastern part, and Gungal is abundant throughout the forest, forming stems up to 5 feet in girth and 40 feet long. *Xylia dolabriformis* is less common in the Bamboo than in the Bijasal forest, and does not anywhere in the reserve attain any considerable size, though stems 3 to 4 feet in girth are not uncommon, and seedlings, as already mentioned, are abundant.

Blackwood and Teak

18. It now remains to say a few words regarding Blackwood (Shisham) and Teak. The former tree is not uncommonly found in all parts of the reserve, but nowhere attains a large size; however, it seeds freely, and seedlings are common. Several tracts in the reserve are said to have produced large-sized teak, and well-shaped poles and saplings are found over a considerable extent, chiefly in the Bamboo forest, of which the following localities are the most noteworthy :—

1*st.*—The Taroba Block, where teak saplings are found in the Bamboo forest, chiefly in the Jamnee Valley and north of the Taroba tank, as well as in the valleys further west between the hills and on the plateau to the north of Panderpori.

2*nd.*—In the Palusgaon Block, in the vicinity of the range of hills which forms the watershed between the two branches of the Andhari.

3*rd.*—Goverdhan Block, in the fork between the two Andharis and south-west of Soosa.

4*th.*—The Eastern Block, all over the Dhoonee hills, especially at the head of the Dhoonee Valley, on the Kolsah plateau and near Pangasghiree, and along the Dhoonee River.

Teak seeds freely in the reserve, and the seed germinates readily, but the seedlings are small, and many are killed during the hot season; others only die down to the root, and shoot up again.

Acacia.

19. In conclusion, three species of *Acacia* should be mentioned—Khair (*Acacia Catechu*), Kárkhair (*Acacia ferruginea*), and Hewar (*Acacia leucophlœa*). Large trees of Khair are not common, but young growth, chiefly coppice-shoots, is abundant in most parts of the reserve. *Acacia ferruginea* is not as common, but attains a larger size. *Acacia leucophlœa* is common in the south-eastern corner, on a tract of alluvial soil, where it attains a large size. No Katha is made, nor is the bark of Hewar collected. I may, however, mention that near the village of Mingheri, about 12 miles north of the northern boundary of the reserve, I found people engaged in preparing the bark of *Acacia leucophlœa* for export.

Revenue.

20. The revenue and charges since the formation of the Moharli Reserve appear from the following statement* :—

Year.	Receipts.	Charges.	Surplus.	Deficit.
	Rs.	Rs.	Rs.	Rs.
1873-74 ...	3,606	4,408	.....	802
1874-75 ...	10,000	10,084	.....	84
1875-76 ...	12,219	11,612	607	.....
1876-77 ...	13,374	15,759	.....	2,385
1877-78 ...	18,895	15,456	3,439	.....
1878-79 ...	21,575	8,451	13,124	.....
1879-80 ...	21,724	10,384	11,340	.....
1880-81 ...	22,232	11,048	11,184	.....
1881-82 ...	26,439	10,704	15,735	.....

Bamboos.

21. Of the revenue, the chief item is the amount paid for bamboos and articles manufactured from Bamboo.† These articles are chiefly exported to the open country in the Wardha Valley, and the principal outlets are Moharli, Sitarampet, and Kutunda; a considerable quantity goes out to the north *viâ* Kulara, and much of this finds its way to the open country round Hinganghat. Smaller quantities are exported eastward, and no Bamboos are exported south. As already explained, the area where mature Bamboos are at present available is limited, and the oldest of the young Bamboo clumps will probably not be fit for cutting for the next five years.

The chief article is Bamboos under 15 feet in length, upon which the rate is one rupee per hundred; a much smaller quantity of Bamboos more than 15 feet long is exported, and rated at Rs. 1-8 per hundred. Different rates are fixed for a great variety of mats

* This statement has been brought up by me to the end of 1881-82.—W. S.

† The revenue derived from the sale of Bamboos in 1881-82 amounted to Rs. 12,467.—W. S.

and baskets, and, in addition to these rates, the workers in Bamboo pay eight annas per mensem a head for men, and six annas a head for boys, for the privilege of taking away Bamboos and working them up into various articles, the rate being realized by Government on the manufactured articles from the exporter.

Yield of Bamboos.

22. As already stated, the largest amount of Bamboos exported in one year amounted to about seven lakhs.* The export of baskets of all sorts during the season of 1875-76 amounted to 54,000, and the number of mats of all sorts amounted to over 202,000. It may, however, be doubted whether, in the present state of the lines of communication, the demand for Bamboos will be equal to the very large supply which will become available when the present young growth of Bamboos has attained maturity. For the country around Hinganghat there is no Bamboo forest which could compete with Moharli, and, under these circumstances, one of the most important measures for developing the revenue of that reserve seems to me to be to improve the lines of export in that direction. I understand that, from surveys lately made under the Conservator's orders in the Bamboo forest of Sonawani, the number of clumps to the acre was from 130 to 145, and that these clumps had produced, during 1876, 270 shoots per acre on an average.

That year was, however, exceptionally dry, and the average production of shoots per acre in Sonawani is probably much larger. Of the total area of Moharli, 100,000 acres may fairly be classed as Bamboo forest; it is difficult to form an idea of the number of Bamboo clumps per acre, as the clumps are growing and in most cases not yet formed; but, considering the character of the soil, I should be inclined to think that 25 clumps per acre and an average annual production of two shoots per clump, fit for cutting, would be within the mark. This would give 5,000,000 of marketable Bamboos, and at the rate of one rupee per 100, this would yield Rs. 50,000 as gross revenue per year. It must not, however, be thought that, if the export lines were improved, all parts of the forest would be worked equally; the eastern portion of the reserve is more distant from the market and would naturally be worked less than the central and western portions. Although, therefore, 50 lakhs of Bamboos might be available, they would not all be exported.

Cost and price of Bamboos.

23. At present, the people who come up with their carts for Bamboos from the Wardha Valley pay Re. 1 for 300 Bamboos to the cutters, the cost of carting from Moharli to Hinganghat may be put down at Rs. 8 to Rs. 10 per 1,000, while the rate paid to Government is Rs. 10, so that the prime cost of Bamboos delivered at Hinganghat may be estimated at from Rs. 21 to Rs. 23 per 1,000. The price of these Bamboos at Hinganghat is stated to be Rs. 45. At Nagpur, where the nearest Bamboo-producing locality is south of the Satpura Reserve, the average price of these bamboos is Rs. 40 per 1,000.

Timber.

24. Of timber exported, the chief articles and the rates levied on them are as follows:—

Askurus—(cart axles)—made entirely of Dhaura, large and straight-grained trees being felled for this purpose, and split up into the rough axle; on these, the rate is Rs. 6-4 per 100, or one anna each. An inferior Askuru is also made from straight branches, which are exported in the round state; on such, the rate is Rs. 3-2 per 100, or half an anna each. In the season from 1st November 1875 to 31st July 1876, the number of split Askurus exported amounted to nearly 49,000, and of round Askurus to about 7,000.

Dandees—(the pole of a Bakhar)—made from Tendu, Bhira, Mokha, and Seena. The rate is Rs. 8 per 100, and the number exported in the season of 1875-76, when, however, the rate was only Rs. 4 per 100, was 17,000.

Dhooras—(cart poles, always used in pairs)—made of Tendu; Bijasal is more prized for this purpose. The rate is 2 annas each, or 4 annas a pair, and the number exported in the season of 1875-76 was 1,850.

Khakers—(rafters for building)—made of various kinds of wood. They are divided into two classes, those from 12″ to 18″ in girth at the thick end, and those under 12″ in girth. The rate on the former is Rs. 8, and on the latter Rs. 4, per 100. The total number exported last season (when the rates were somewhat lower) was about 9,000.

Myals—(small beams and logs)—of various woods. The present rate is 3 annas per cubic foot, and the number exported last season was 1,800.

Moondahs—(posts used as uprights in building)—of various woods. The rate is 3 annas for large, and 1½ annas for small, and the number exported last season, at slightly lower rates, was 5,000.

Puttee—(horizontals in building, resting on the Moondahs)—made of various kinds of wood. The rate is Rs. 8 per 100, and the number exported last season was over 3,000, the rate being at that time Rs. 4 per 100.

Besides these, a large variety of pieces used for agricultural implements are exported. Upon the whole, it may be said that the export of building wood is less than that of wood for agricultural purposes. The whole of this export, like that of Bamboos, goes to the open country in the west.

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* The quantity exported in 1881-82 is estimated to have amounted to about three times that number.—W. S.

25. For firewood and charcoal Rs. 112 were realized in 1874-75, and Rs. 107 in 1875-76. This is all for local consumption. These are very small sums, but it may be confidently expected that, eventually, the rich iron ores, which are found in abundance to the north-east of the reserve, will utilize a large quantity of the wood produced in the reserve. Several villages in the vicinity of Nullesur have, as a matter of fact, drawn their supplies of charcoal for iron smelting from the reserve, and the poor character of the forest growth in the vicinity is attributable to this circumstance. There is therefore a good chance of revenue from this source at some future time.* Firewood and Charcoal.

26. Grazing dues, thatching, and a small quantity of fodder grass realized Rs. 1,195 in 1874-75 and Rs. 1,282 in 1875-76, and this year's revenue is estimated at Rs. 2,500. Grazing dues and minor produce.

Minor produce in 1874-75 yielded Rs. 2,426, and the next year Rs. 2,187. This consisted chiefly of Lac, Harra, Horns, Gum, Honey, Wax, Chironji, Mohwa, Hides, &c. The right of collecting Mohwa is leased to contractors for a certain sum annually, on the understanding that the people who collect for them keep three-fourths while they take one-fourth. This is the usual custom in the Chanda District. Harra, Horns, Lac, and other minor produce is collected now on Government account. The yield of Lac this year has been *nil*, because none was produced during the hot weather of 1876.

27†. Only two blocks have as yet been taken under fire protection—the Taroba Block, area 24,472 acres, in 1873, and the Goverdhan Block, area 13,931 acres, in 1874. It is desirable that fire protection should be gradually extended, so as to include, at any rate, all the important Teak and Bijasal-producing tracts. Fire protection.

28. The future revenue prospects of this reserve will, to a great extent, depend upon the demands that may be made on it for charcoal for iron smelting; but as this is uncertain, we shall not take it into consideration at present. The most valuable product, as already mentioned, is, and will probably always remain, Teak; but, with the exception of certain limited tracts, the soil in the reserve is too dry to admit of a vigorous growth of Teak. Future management.—Teak.

29. Bijasal is the wood which stands next in value. It is believed to command about half the value of Teak as poles, and probably a larger proportion (4 to 7) in the log. A small quantity of mature Bijasal timber is found in the ravines of the eastern hills, and I do not advocate that any mature Bijasal should be cut in the reserve for many years to come, nor do I advocate the cutting at present of any Bijasal poles. Though this tree does not command much more than half the price of Teak, still it is certain to command much higher rates per cubic foot, whether cut into poles or logs, than any of the other woods, and therefore the proper policy is by all means to encourage the growth of Bijasal at the expense of other trees. The tree seeds freely, not every year, but from time to time, and when it seeds produces a large quantity of seed. Now it is well known that many kinds of trees which produce abundance of seed at one time thereby get the upper hand, and upon this I base the hope that, if protected from fire, this tree may be made to predominate in this forest on all soils suitable to its growth, provided all seed-bearing trees are spared, and as many other trees and Bamboos are cut out as possible. This is the policy which I advocate for the Bijasal tracts. Bijasal.

As soon as the Bamboos in this forest are fit to cut, I would advocate that, for some time, the Bamboo cutting be mainly concentrated in the Bijasal tracts.

30. The question may be asked whether it would not be good policy to encourage the growth, besides Bijasal, of some of the other more valuable trees; and of these Dhaura seems to merit first consideration. We have not, at present, sufficient data at our disposal to estimate the relative value of these different kinds of woods, but the following data may be held to give some indication in this respect. The principal articles cut from Dhaura are Askurus, 6 feet long and 6 inches in diameter; they are split from straight trees which are selected on account of the straightness of their grain. A moderate sized tree, measuring 25 cubic feet, is believed, if sound and of good quality, to yield 12 to 13 axles, which, at the rate of Rs. 6-4 per 100, corresponds to 12 to 13 annas per 25 cubic feet, or half an anna per cubic foot. Now there seems good reason to believe that Teak sold in the reserve would fetch from 3 to 4 annas per cubic foot, and that Bijasal would fetch about half that rate. Dhaura is also used for house posts and rafters, the larger size being 12″ to 18″ at the base, and 15′ to 20′ long, paying Rs. 8 per 100. Dhaura.

Regular enquiries regarding the relative value of the different kinds of timber should be made, for they must regulate the management of these forests.

31. Regarding the speedy cutting out of Bamboos from the Bijasal forest, there can be no doubt, for seedlings of that tree have no chance under the cover of the Bamboo. This Cutting out of Bamboos and other trees.

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* The question of starting large iron-works is under the consideration of Government. Efforts are being made to induce private parties to take the matter up.—W. S.

† This paragraph was found blank in the manuscript; I have filled in the above data.—W. S.

will give some room for seedlings to spring up, but more space must be given by the cutting out of other trees. In the case of most kinds it will be possible to effect this without incurring any expenditure; but there are some kinds—such as Gungal, Salai, and Goti—which are not likely to sell, and which must, therefore, be removed or killed, though this may cause some outlay. I would here specially draw attention to the trees with spreading branches, which very materially interfere with the vigorous and regular development of a timber forest. Attention should be paid to the removal of these in the first instance.

Young growth of Bijasal.

32. The measures here advocated will probably have the effect of giving sufficient space for an abundant growth of seedlings, among which Bijasal will then probably predominate; and, when this young growth is sufficiently advanced, then no time should be lost in cutting out all marketable timber. I am told that at present patches are found here and there covered with young growth, in which Bijasal predominates, or which entirely consist of it. Wherever such patches are of any extent, the object aimed at by the preliminary cuttings here advocated has already been attained, and in such places any marketable trees of Bijasal may at once be cut out. But we have no evidence as yet that Bijasal is at all to be compared to Sál in its gregarious habits, or that there is any risk of the treatment here advocated producing a pure Bijasal forest.

The general principles here explained must, as a matter of course, be applied to each individual case with judgment, according to the requirements of the forest; but it is useful to set forth these general principles, although their application may have to be modified in individual cases.

Extension of permanent fields in the reserve.

33. In the vicinity of the villages, much good may be done to the forest by permitting the lopping of branches of the less valuable trees for manure on the paddy fields. At present, the villages which are not provided with their own forests are so few in the reserve that their demands would make no impression on the forest; but it is for consideration whether new paddy fields might not be formed either by restoring old tanks in deserted villages, or by establishing new paddy fields in some of the low ground covered with stunted forest. This is, however, a matter for future consideration; and the question what area should be kept under forest and what area should be thrown open for cultivation must, to a great extent, depend on the prospects of an extended iron manufacture, and consequently an increased consumption of wood for charcoal burning.

Cultivation of Teak.

34. In Moharli attempts have been made to cultivate Teak by transplanting the seedlings that are about a fortnight or a month old into Bamboo baskets, and by planting them out into the forest, basket and all, when the plants are a year old. In 1875 this procedure was very successful; the seedlings were planted into the baskets in July and August, and were thus sufficiently strong to resist the dry season; the baskets were then planted out in July 1876, and only a very small percentage of those planted out have died. In 1876 the seed was sown in beds, and in July about 1,900 plants were potted into baskets; in August, these plants, with their baskets, were put out into the forest; at that time they were on an average 3 inches high, whereas those of the previous year were 9 inches high, on an average, at the time of planting out into the forest. Of the seed sown in 1876, a proportion only germinated in July; a large number (about 4,000) germinated in August, and were potted into baskets at the end of August; these are now in baskets, and a large proportion have died. This is ascribed to the fact of the early cessation of the rains, and to the hot dry weather in September, October, and November, and also to the fact that these seedlings when put out into pots were much smaller than those put out in July.

This is a very interesting experiment, and I understand that the object was to ascertain how far this treatment will enable Teak seedlings to succeed in the dry and somewhat poor soil of that part of the reserve in which they have been planted. Seedlings thus treated are, however, exposed to considerable risks from the following causes. The baskets are exposed to attacks by white ants, which, however, can be guarded against by the employment of wood ashes. The effect of the dry air circulating round the baskets, and the consequent evaporation, however much the baskets may be watered, must be injurious. Some of those put out in 1876 (of the crop of 1876) were attacked by grubs, which were probably bred in the manure, while some of the baskets were attacked and destroyed by wild pigs in search of food. The result of the experiment should be carefully watched and recorded in detail in the journal of the reserve.

Forest garden at Moharli.

35. No experiments have been made with regard to the cultivation of Bijasal, nor is it intended to make any, nor does it seem necessary to do so at present. Near the Forest House at Moharli is a garden, which should be increased in size and utilized for the experimental cultivation of any trees that may be thought likely to succeed in the climate and soil of Moharli. I understand that the Conservator intends to try Anjan and *Casuarina*, and I would suggest that fresh experiments be made with Sandalwood. Unsuccessful experiments have been made with Sandalwood for two years, but there seems little doubt that they must eventually succeed, and it is not impossible that in the sandy soil of this forest the Sandalwood will develop a well scented heartwood.

36. I have already stated that it would be premature at present to sub-divide the reserve completely into blocks and compartments. Before this is done, it will be necessary to acquire further experience in the demand for forest produce, quite apart from the fact that the plan of working these forests will be greatly affected by the question whether any part of it shall yield fuel for iron making; but it will not be premature here to state a few leading principles by which the sub-division of this reserve into blocks and compartments must be guided. **Sub-division of the Forest into Blocks and Compartments.**

In the hilly portion, which, as previously explained, comprises the western and eastern parts, I feel convinced that the correct plan will be to use the existing lines of export, or those by which timber, bamboos, and other forest produce may be carried to the lines of export, and in consequence these lines will generally follow the valleys. It appears to me that the character of the forest and of the ground does not make it necessary to follow any other consideration in the formation of blocks, although, of course, when the time comes to form compartments, the natural conditions which influence forest growth must be duly considered. Thus, in the Taroba Sub-Division, I am inclined to think that the road from Jamnee *viâ* Panderponi to Bhamashindi will be an important sub-division line, and that another line will follow the cart road from Panderponi to Taroba Tank and thence to Katejhiree and Wudala Tukon. From these remarks it will be evident that the greatest attention must, from the commencement, be paid to be maintenance of existing roads, especially of those which can be so improved as to be used for cart traffic. In the fire-protected blocks especially, I cannot urge in sufficiently strong terms that, as a rule, existing roads should be kept open, and that traffic on them should be encouraged, the sides of the roads being kept clear as a safeguard against fire. Fire protection will, I feel sure, be facilitated, and the risk of accidental fires spreading be greatly diminished, if care is taken to keep open as many roads as may be necessary to make each portion of the forest easily accessible. We cannot, of course, expect that traffic will do much to keep these roads clear, until the export of Bamboos and wood has increased considerably; but when that traffic has been developed, the correctness of the present remarks will be recognized. Of course two considerations must be kept in view—viz., the cost of maintaining the guards requisite to watch the traffic, and the cost of clearing roads on which traffic has not yet developed; but, as a general rule, I strongly deprecate allowing a fire-protected forest to grow up into an impenetrable wilderness, for we have no means of stopping accidental fires, and when the time for working the forest arrives we shall have the whole expense of cutting fresh export lines. **In the hills.**

37. In the more level portion of the forest, and particularly the basin of the Andhari River, it will, I feel convinced, eventually be found a great advantage if we now endeavour to approximate the sub-division lines of the forest to straight lines. It may not be possible to carry out this principle to the same extent as has been done with great success by Captain Wood in the Oudh Forests; but the lines which will divide blocks and compartments, and which will here, as well as in the hilly portions, serve for the carriage and export of forest produce, cannot probably run straight for very long distances on account of ravines and other inequalities of the ground, but stretches of straight lines, even if only a few hundred yards long, are exceedingly useful to assist in fire protection. In order to explain what I mean, I will mention the northern boundary of the Goverdhan Block, which is a road running from near Botejhiree on the Andhari to near Moharli; the present line, which was beautifully cleared to a width of 40 feet at the time of my visit, follows the somewhat meandering course of the cart road, this road running on one side of the line. It might quite as well have been cut in a succession of straight lines, with slight bends and angles of course, as the configuration of the ground demanded, and in that case the present cart road would sometimes have been in the middle of the line and sometimes on its edge; but we should always command a long vista, which naturally facilitates protection. On lines likely to be important for the export of forest produce, and which shall at the same time serve for fire protection, I am inclined to recommend, in the more level part of the forest, the clearing of lines only 15 or 20 feet broad, with a regularly made road in the middle. Lines of this width keep themselves clear of grass and undergrowth, to a great extent, by the shade of the adjoining forest; and although they get covered with dry leaves during the hot season, it is a question whether the sweeping and the burning of these dry leaves, if done by the regular fire watchers, is not less expensive on these narrow lines than the keeping clear of broad lines during the hot season. I offer these remarks because I noticed that on the line already mentioned from Botejhiree to Moharli a number of trees were left standing, the fallen leaves of which must be burnt repeatedly during the hot season. **On more level ground.**

What I wish to advocate for the more level portion of this forest are lines 15 to 20 feet broad, following the general direction of cart roads and other lines of communication, but cut as straight as possible. In the formation of compartments and sub-compartments, such marked features as the limits of the Bijasal-producing land will, of course, receive due consideration, but the chief sub-division lines of the forest should be as much as possible those which will be useful for the export of produce.

38. The present establishment of Moharli consists of 4 Foresters and 8 Forest Guards, and it is intended to divide the forest accordingly into charges and beats for the Guards. **Establishment.**

Besides these, a temporary establishment is entertained for fire protection from the 15th November until the commencement of the rains, whose work it is to clear and maintain the lines and to patrol them during the hot season.

The estimated cost of fire protection for the current year is as follows :—

Block.	Area.	Length of fire lines.	Cost of clearing and maintaining lines.	Cost of patrolling lines.	Total cost.	Rate per	
						Square mile.	Mile of lines.
	Square miles.	Miles.	Rs.	Rs.	Rs.	Rs.	Rs.
Taroba ...	40	49	384	593	977	24	20
Goverdhan ...	21·5	23	164	337	501	23	22
						Average.	
Total ...	61·5	72	548	930	1,478	24	21

Revenue Establishment.

39. Besides this establishment, there is the revenue establishment, posted at the Nakas, at which the revenue for produce exported is paid: there are 7 Nakas on the borders of the forest, and at each Naka there is one Mohurrir and 2 Chaprasis; the collections are paid into the Chanda Treasury daily.

Intermediate between the Nakas there are minor posts, at which one Chaprasi is stationed, but no revenue is levied at these posts. The total revenue establishment consists of 7 Mohurrirs and 27 Chaprasis, and they are entertained from the 1st November to the 30th of June: the pay of the Mohurrirs is Rs. 10 (with one exception), and the pay of the Chaprasis Rs. 6, and the cost is in round numbers Rs. 230 a month; but the whole strength of the establishment is not entertained during the 8 months. The receipts for the amount paid, which serve as passes, are granted by Mohurrirs, and the establishment of the unreserved forests, situated outside on the main lines of export, exercise a sharp control over the produce exported and the proceedings at the Nakas.

As a matter of fact, the Mohurrirs and Chaprasis of the Nakas are mainly Mahomedans, whereas the unreserved Forest Establishment is composed of Mahrattas. It is believed that the check on the produce exported from the Moharli Forest is fairly complete; but as soon as the demand has increased, and the working of the forest becomes concentrated upon limited blocks every year, it will not be difficult to establish a system which can be controlled more efficiently than it will ever be possible to control the Naka system.

3.—THE AHIRI RESERVES.

The Ahiri Forests, which were finally purchased from the Ahiri Zamindar in 1873, consist of two blocks, Bhimaram and Mirkullu. The former was demarcated in 1868, and the latter in 1869. The purchase money was Rs. 1,00,000, of which Rs. 20,000 were paid down, the rest remaining standing, for which Government pays Rs. 4,000 at the rate of 5 per cent. per annum. A third block, called the Alapilly Block, mainly for depôt purposes and for experimental plantations, measuring 766 acres, has recently been acquired by exchange.

2. According to a survey made by Mr. Brereton in 1868 and 1869, the area of Bhimaram is 12,296 acres, and of Mirkullu 8,479 acres.* In the Alapilly Block there is a village, but neither Bhimaram or Mirkullu contains cultivation or villages, nor are any rights or privileges exercised in these blocks.

3. In 1868 the Bhimaram Block was surveyed by Mr. Brereton, and a map prepared on the scale of 8 inches to the mile. In 1869 he surveyed the Mirkullu Block on the same scale. In 1874 a survey of the Zamindari was made by the Central Provinces Revenue Survey, and a manuscript map of the forests on the scale of 2 inches to the mile was obtained, the printed maps of the country being on the scale of 1 inch to the mile.

As regards Bhimaram, the Revenue Survey map gives as much detail as Mr. Brereton's, and is somewhat fuller in topographical details; but as regards Mirkullu, Mr. Brereton's map contains more details.

* During the last few weeks an additional area of about 110 square miles has been bought for Rs. 60,000, the whole forming now one compact block of about 142 square miles. Mr. Brandis' description refers only to the original blocks.—W. S.

4. The boundary lines of both forests consist of cleared lines 40 feet wide, with boundary pillars at all angles, and otherwise at convenient distances. These boundary pillars consist of squared pieces of teak let into the ground to a depth of about 9 inches, and surrounded at the foot by heaps of stones 2 feet high. In Bhimaram the pillars stand out 2 feet 9 inches above the stones, the upper 9 inches being cut into a pyramidical shape. In Mirkullu these pillars stand higher. The lower part of the pillars was charred before being let into the ground. Each pillar has a current number, those of Bhimaram running from 1 to 67, and those of Mirkullu in the northern or Mungair Block from 1 to 19, while those in the southern run from 1 to 159. The Bhimaram Block is 8½ miles long from north to south, and its greatest width from east to west is 3¼ miles. The main Mirkullu Block has the same length, and a maximum width from east to west of 3 miles. The length of boundary lines of the Bhimaram Block is 28 miles, and of the two Mirkullu Blocks 34 miles. A glance at the map will shew that the boundaries of the Mirkullu Block are more indented and more irregular; hence their greater length. The principle followed in selecting the boundaries was to include none but Teak-producing forest, and to interfere as little as possible with the requirements of existing villages in the vicinity of the forests. **Boundaries.**

5. Outside these forests the chief Teak in the Zamindari that is known to us is between Kirseni and Indarum, south of Ahiri, and in the land intervening between Bhimaram and Mirkullu, between the old and new sites of Tilwanu* village. The Teak forests of this Zamindari were first described by Captain Stewart. A much earlier mention of the Teak in this part of the country, however, is found on a map made by two officers of the Nagpur Irregular Force.

6. The drainage from the Bhimaram Forest runs into two nalas, which join the Pranhuta River—the Alapilly Nala, which drains the northern part, and the Palla Wâg, which drains the southern part. **Bhimaram.**

The northern half of Bhimaram is level and slightly undulating; through the southern part runs an isolated range, rising at its highest point a few hundred feet above the surrounding country. Its eastern slope is steep, while to the west it sends out a number of spurs and branches, with a large area of slopes with gentle gradient. The Bhimaram spur, on the northern end of which is a Gond temple, is rocky and stony.

7. The rock of Bhimaram is crystalline, chiefly granitoid in the hills, with large separated masses of felspar and quartz. In the level parts dykes of quartz are common.

The only permanent spring known in the Bhimaram Forest is the Pata Neel spring, at the head of one of the valleys which run down to the west. Since fire conservancy has commenced, several pools containing water permanently are now found in the Sherpilli Nala, which rises at the north-east end of the hills and joins the Alapilly Nala above the village of Alapilly. Water can also now be obtained in several other nalas by digging for it in the sand.† Before fire conservancy commenced, the water-supply in the reserve was a matter of extreme difficulty, while it can now be had in many places. The scarcity of water is a feature not peculiar to these two forests, but common to the entire surrounding country, and it has been noticed that many villages had to be deserted from the want of water after they had bared the country in their vicinity by Dhya cultivation.

8. The soil in the whole of Bhimaram is an exceedingly rich, light loam, in a few places dark reddish brown, but as a rule of a black colour, which is due to the large proportion of vegetable mould it contains. In the northern portion, especially on the west side, the rounded masses of granite rock appear above the surface, and in others, to judge from the character of the vegetation, the soil is shallow; but in the greater portion of the area the soil is deep and remarkably well suited for forest growth. In the same manner on the hills the soil is shallow and rocky on steep slopes, but deep and exceedingly favourable for forest growth on the flat tops of the ridges, on gentle slopes, and in dells and valleys. No more favourable conditions could be imagined for the development of a high timber forest of first quality. **Soil.**

9. The character of the forest is different in the hills and the level portion of Bhimaram. On the hills, Bamboo (*Dendrocalamus strictus*) is the chief constituent of the forest, and the chief kind associated with it is Teak. Over large areas, the forest consists of large trees of teak between Bamboo clumps, with here and there a few scattered trees of Blackwood, Bija, and Kaim, Kosum being common in the valleys. Where the valleys open out, and at the base of the hills, the forest in the southern portion is more varied in character. Saj, Moyen, Hewar, Kaim, Haldu, Tendu, and Dhaura being common, with large quantities, in places, of Ghoraru and *Eriolæna*. On the hill in the southernmost corner of the reserve a small quantity of *Hardwickia* is found, which is more common outside of the reserve. **Character of forest.**

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* Since then other additional Teak localities have been discovered.

† Further experience has borne this out.

In the northern portion of Bhimaram, three forest types may be distinguished. In the vicinity of the streams and on low ground between their feeders, the forest consists chiefly of Saj, Tendu, the two *Naucleas*, with a varying proportion of Teak, and a number of scattered trees of Hewar, with Kosum, Anjan, and *Pongamia* fringing the banks. At this season the shade of this description of forest is dense, and the young growth consists chiefly of Saj, Tendu, with Ghoraru here and there, and a mixture of *Holarrhena* and *Xylia*. Wherever there is sufficient light in this type of forest, young Teak has sprung up most vigorously, and it will be a matter of great importance in this class of forest to give sufficient light, in order to increase the crop of young Teak.

The second type is found on high ground, where the rock is close to the surface and the soil shallow; here Saj, Tendu, *Buchanania*, Dhaura, and Moyen are the chief trees, with a proportion of Teak, which have produced in places a large number of saplings, which, as the soil improves by continued fire protection, will grow up into a most valuable forest.

The third class of forest may be designated as the Teak forest. It occupies considerably more than one-half of the level portion of Bhimaram, and covers almost exclusively that portion which is north of the road from Alapilly to the old site of Tilwana. In the forest of this type, Teak is the dominant tree. With it are associated Saj, Blackwood, Kaim, and Tendu, besides a large number of other species, which will be found in the abstracts of valuation surveys given further on.

Of the trees which do not attain first class, and which generally have a slower growth, it will be necessary here to mention Ghoraru and *Butea;* the former is exceedingly common, the largest attaining four feet in girth and a considerable height; extensive patches are covered with young growth of this tree. The large number of Palas trees in this portion of the reserve, as well as in the valleys of the southern portion, is remarkable. Here and elsewhere it is a spreading bushy tree, which throws heavy shade and does not as a rule permit any young growth to come up under it.

It is obvious that the forest on the hills and the three types of forest on the level ground will require different treatment.

Valuation surveys.

10. In order to determine the growing stock of these forests, several enumerations of Teak trees of the different classes have been made. The first was made by Captain Jarrett for Bhimaram in 1869. A line running north and south, dividing the forest into two unequal halves, was cut, and by secondary lines, generally running at right angles from the centre line, the forest was divided into 66 compartments, which were generally long and narrow.

In each compartment counters were employed, who were followed by other men who marked by brush and white-wash the trees counted. Ten compartments in the hilly portion were not actually counted, but the contents were estimated. The sound and unsound trees were counted separately. The number of sound Teak and Blackwood trees was as follows:—

	Teak.	Blackwood.
I Class, in girth above 6′	50,204 trees.	2,552 trees.
II Class, do. 4′ 6″—6′	45,921 do.	7,164 do.
III Do., do. 3′—4′ 6″	86,778 do.	33,989 do.
IV Do., do. 1′ 6″—3′	71,578 do.	14,980 do.
Total	254,481 do.	58,685 do.

Besides these, 94,949 unsound Teak trees of all classes, and 13,435 unsound Blackwood trees of all classes, were counted.

The result per acre is as follows:—

Teak, I class, sound	4
Blackwood, I class, sound	$\frac{1}{5}$
Teak, all classes, sound and unsound	28
Blackwood, all classes, sound and unsound	6

11. In order to fix the purchase money, it appeared desirable to have a second enumeration made, with which Mr. Hicks, Assistant Conservator of Forests, was entrusted. The result was as follows:—

	Teak.	Blackwood.
I Class	11,613	749
II Do.	21,809	5,001
III Do.	31,947	15,157
IV Do.	33,284	8,710
Total	98,653	29,617

Besides these, unsound trees of all classes were counted as follows:—

Teak	96,554
Blackwood	15,584

12. It is difficult to reconcile the great difference between the results of these surveys. It is probable that the figures of the earlier survey are too large, and those of the last too low. This supposition is borne out by the results obtained from a system of most

carefully executed linear valuation surveys made in 1876 by Mr. Thompson. A number of straight lines were laid through both the level and hilly parts of the forest, 66 feet wide. On some of these lines every thing was counted and recorded acre by acre, 10 squares, 66 feet by 66 feet, being an acre, and the growing stock was counted on each square separately.

The trees were measured by a diameter gauge (Kluppe) and classified as follows :—

I	Class, diameter	24 inches and upwards, measured at breast height.
II	Ditto	18 to 24 inches.
III	Ditto	12 to 18 do.
IV	Ditto	6 to 12 do.

Through the level portion 3 parallel lines were laid, running from north-east to south-west and intersecting the drainage nearly at right angles, in addition to a short line in the south-west corner. The aggregate area of the valuation lines in this portion of the reserve was 78 acres. On one line, running through the heart of the northern portion and measuring 34 acres, the trees of all kinds of the four classes were counted, and the result gives the following figures per acre :—

Species.	I Class.	II Class.	III Class.	IV Class.	Total.
Teak	2·67	1·47	2·56	4·17	10·87
Sissoo	0·06	0·44	2·14	1·70	4·34
Saj	1·41	2·39	3·11	6·50	13·41
Kaim	0·91	1·38	2·06	0·73	5·08
Kosum	0·14	0·11	0·18	0·20	0·63
Haldu	0·23	0·09	0·00	0·59	0·91
Bija	0·03	0·24	0·50	0·24	1·01
Other species*	0·53	1·06	7·70	44·88	54·17
Total ...	5·98	7·18	18·25	59·01	90·42

This line included portions of forest of the three types already described, but it is impossible to say in what proportion, and therefore it cannot be used further to characterise the growing stock of which the forest in each type consists.

13. Besides the trees of the four classes, all saplings and seedlings of Teak, Bija, Sissoo, and Kaim with a diameter of less than 6 inches, and so high that they could readily be seen, were counted. The number of seedlings and saplings of Teak was found to be very large. On 34 acres, 141 trees of the two first classes were counted, and no less than 4,771 saplings and seedlings, or more than 30 to 1 of the seed-bearing trees. It must, however, not be forgotten that a much larger number of teak trees formerly stood on the ground in this forest, the majority of which were cut either for Dhya cultivation or for export. The number of Teak stumps counted on these 34 acres was as follows :—

			Per acre.
I Class	129.	...	... 4
II do.	138	...	... 4
III do.	105	...	... 3
Total ...	372	Total	... 11

A large, if not the larger, proportion of saplings and seedlings now on the ground owe their existence to the seed shed by these trees, of which the only remains left are their stumps. It is well known, and need not here be explained, that formerly, under the operation of the annual fires, seedlings were burnt down to the ground year after year, and that many of the saplings now counted may originally have sprung up more than 50 years ago.

14. The number of Bija seedlings bears a similar proportion, 30 to 1, to the seed-bearing trees; indeed, no one who examines this portion of the forest in detail can help being struck by the large number of Bija seedlings on the ground, compared with the very small number of seed-bearing trees. The timber of this tree has never been exported from this forest, and there is no reason to believe that the number of seed-bearing trees was larger in former years. On the contrary, it is probable that it was less formerly, when the number of Teak trees was larger; but in this case the large number of Bija seedlings is readily explained by the abundant amount of seed produced by this tree and by the circumstance of its being readily spread by the wind.

* The most important species entered in the above statement as "Other Species" are as follows (in the order of their numerical importance) :—Tendu, Dhaura, Moyen, Garuga, Mokha, Padul, Lendya, Kowa, Kumbhi, Jamun

Of other trees, saplings only were counted in this survey, comprising all plants 8 feet high and upwards, and with a diameter of less than 6 inches. The results regarding the chief trees were as follows :—

		Per acre.
Saj	543	16
Dhaura	265	8
Kosum	145	4
Lendya	131	4
Moyen	59	2
Mokha	33	1

The large number of saplings of Dhaura, Kosum, and Lendya is very remarkable. As regards Saj, the number of saplings counted gives no idea whatsoever of the abundance of young growth in this portion of the forest; extensive patches are covered with masses of young growth of this tree from 3 to 4 feet high.

Upon the whole, it is apparent from these figures, and equally so from the examination of the forest, that the conditions are extremely favourable for the regeneration from seed of several trees, of which Teak, Saj, Bijasal, and Ghoraru are the principal. I have never seen anything to compare to the dense masses of young growth of these trees; and if the treatment of the forest is at all judicious, the results are sure to be favourable beyond all expectation.

15. The other valuation surveys made in the northern half of Bhimaram are of less interest, as the trees of all kinds were not counted: they therefore give only a partial representation of the growing stock. The following is an abstract per acre of the results of the whole of Mr. Thompson's surveys in the plains part of the Bhimaram block extending over 78 acres, which includes also the survey of the 34 acres previously mentioned :—

No.	Species.	I Class.	II Class.	III Class.	IV Class.	Total.
1	Teak	2·410	1·718	3·153	6·089	13·370
2	Sissoo	0·051	0·410	1·846	2·718	5·025
3	Saj	1·461	2·038	2·820	6·282	12·601
4	Kaim	0·743	1·012	1·641	1·141	4·537
5	Kosum	0·115	0·192	0·115	0·166	0·588
6	Haldu	0·141	0·051	0·025	0·076	0·293
7	Bija	0·064	0·231	0·410	0·397	1·102
	Total ...	4·985	5·652	10·010	16·869	37·516
	Other species	·238	·483	3·418	19·596	23·735
	Grand Total ...	5·223	6·135	13·428	36·465	61·251

16. In a similar manner, four surveys were laid through the southern or hill portion, aggregating 50 acres. These lines, however, it was not possible to lay so as to be parallel. They intersected the area in different directions. In these surveys the more important trees were counted, and the results per acre are as follows :—

No.	Species.	I Class.	II Class.	III Class.	IV Class.	Total.
1	Teak	4·00	4·28	7·48	8·30	24·06
2	Sissoo	0·06	0·06	1·46	3·50	5·08
3	Saj	0·58	0·54	0·54	2·38	4·04
4	Kaim	0·38	0·40	0·68	1·16	2·62
5	Kosum...	0·24	0·24	0·24	0·34	1·06
6	Haldu	0·12	0·08	0·18	0·34	0·72
7	Bija	0·04	0·08	0·22	0·20	0·54
	Total ...	5·42	5·68	10·80	16·22	38·12

As already explained, these figures do not give a complete account of the whole growing stock in this portion of the forest, for, besides Bamboos, there were, as already mentioned, numerous other trees which were not counted because of less importance as articles of export. So much, however, is clear that teak predominates even to a greater extent than in the northern portion,* which is not surprising, as large extents of the hills are clothed with a forest consisting almost exclusively of Teak and Bamboos.

Export of Timber in the past.

17. Before discussing the principles which should regulate the treatment of the Bhimaram Forest, it will be necessary briefly to state what timber has hitherto been exported from it. Up to 1867, when the management of this forest was taken in hand by the Forest Department, its condition was affected by Dhya cultivation and the export of Teak timber. It is evident that large extents of this forest were at one time cleared and cultivated, and there are the remains of a tank and several rude bunds, called *ghatta*, which are thrown up by the Mareeas in this part of the country for temporary rice fields above the bund. Teak was mainly cut for export in the western and northern portion and in the valleys between the hills in the south. The quantity of teak cut for export it is impossible to estimate. For many years before 1867 the working of the forest was in the hands of Bhugwandass and Company, of Hyderabad, who sent the best timber to Hyderabad and floated the inferior classes to Coconada. No other wood and no Bamboos were exported.

Since 1867 the Forest Department have cut the following trees:—Captain Jarrett cut in 1867-68 1,318 trees almost exclusively in Bhimaram. All these were Teak, selected from among the best sound trees. In addition to these, he cut a few Blackwood trees. In 1872 and 1874, 2,432 trees were cut in the north-western portion (sub-division No. III) of Bhimaram. These trees were selected by Mr. Thompson from among those which were unsound and dying, and the number included a considerable proportion of dead trees. No trees were cut that were required for seed.

Timber from this forest is at present carted during the dry season, or floated down the Alapilly* Nala during the rains to the main river, and thence the rafts are poled up the Wainganga and Kanhan to Kamthi and up the Wardha River to Inlana near Warora.† The chief timber floated up the Wardha River has consisted of sleepers for the Wardha Valley State Railway, in addition to logs and scantlings. The floating up the Wardha River takes place throughout the year, except during April and May, when the river becomes too shallow. This floating up stream commenced in December 1872. The floating up the Wainganga River to Kamthi was commenced in the early part of 1876.

A small quantity of timber was also sent to Coconada in the cold season of 1876; also some Bamboos as an experiment.

Mirkullu.

18. With the exception of a small area on the west of the northern half, the Mirkullu block is hilly throughout, the greater portion being formed by the western slope of a high undulating table-land, the drainage of which runs partly southwards into the Pathra Nadi, which joins the Pranhuta below Dewulmanee, partly into feeders of the Bhanda Nadi, a tributary of the Indravati. That portion of the table-land which adjoins the Mirkullu Reserve is covered with open forest of scattered trees. Half a mile from the eastern edge of the reserve is the village of Mirkullu now deserted, with a tank, from which the reserve derives its name.

The chief road which passes through the reserve is the Bamraghar road, which leads through the northern portion. The hills are chiefly gentle undulations, with few marked features.

Rock and Soil.

19. The rock appears to be similar to that of Bhimaram, but in parts it is distinctly stratified and with more mica, the soil produced by it being more often of a reddish brown colour. With the exception of the flat portion already mentioned, where the soil is deep, the rock everywhere appears on the surface, but it is much disintegrated and broken up into boulders.

Character of Forest.

20. The whole of the hilly portion is clothed with dense Bamboo forest, which is evidently the result of constant Dhya cultivation. On a linear survey of 45 acres made through the northern half of the forest by Mr. Thompson, chiefly through Bamboo forest, 2,548 clumps

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* The Alapilly Nala can hardly be counted upon as a means of transport.

† The present system of timber transport is as follows:—Carting from the saw mills at Alapilly to Kirmirree on the Wardha, or Donarghat on the Wainganga, the former about 36, the latter about 54, miles from Alapilly.

From Kirmirree the timber is floated up stream to Inlana, a distance of 92 miles, and is carted from Inlana to Warora Station, a distance of four miles.

From Donarghat the timber is floated up stream to the point where the Chhattisgarh Railway crosses the Wainganga, a distance of 120 miles.

The floating up stream is effected by poling or pulling by men.

were counted, which is at the rate of 56 clumps per acre. The bamboo here is of remarkably fine growth. We measured a stem, as a sample, 59 feet long and 10½ inches in girth near the base. Although the rains of 1876 have been very scanty, the clumps had produced a large number of young shoots, the number varying from 2 to 6 per clump. This bamboo forest has grown up at different times after the last Dhya was cut and burnt, and consequently the clumps are not of the same age, and the trees standing among them also vary considerably in age and size. We saw large areas on which there were large poles of teak and of a few other kinds. Among the bamboos in other places the trees were larger. Upon the whole, the trees in this bamboo forest are not very tall, the length of bole to the first branch not exceeding 60 feet. Through this portion of the forest two surveys of 34 and 45 acres, respectively, were made by Mr. Thompson, which gave the following results per acre:—

Species.	Class I.	Class II.	Class III.	Class IV.	Total per average acre.
Teak	1·468	2·164	7·341	7·405	18·378
Sissoo	0·063	0·075	0·797	2·949	3·884
Saj	0·556	0·531	1·405	2·113	4·605
Kaim	0·126	0·114	0·493	1·367	2·100
Haldu	0·012	0·012	0·012	0·088	0·124
Bija	0·025	0·088	0·405	0·443	0·961
Kosum	0·037	0·037	0·088	0·291	0·453
Total ...	2·287	3·021	10·541	14·656	30·505

On the western edge, an irregularly shaped strip, about 3 miles long by ½ a mile broad, extends southwards from the Bhamraghar road. In this portion bamboos are scanty and chiefly found along the nalas, where they are associated with *Albizzia procera*. Between these belts of bamboo, the forest is a tree forest, on deep soil, containing, besides teak, chiefly Saj, Kaim, a little Bijasal, and Kosum. This portion of the forest was protected from fire during the hot season of 1876, and the ground under the trees is still to a great extent covered with tall grass, but masses of young Saj and scattered saplings of teak appear above the grass, and this young tree growth will doubtless in the same way, as has been the case in Bhimaram, get the upper hand of the grass. Here, as in Bhimaram, the large number of plants of *Butea superba*, *Dalbergia volubilis*, and other creepers is remarkable; they form part of the undergrowth, but have not yet sent up their many twining stems. A noticeable feature in this part of the forest appeared to us the large quantity of *Helicteres Isora*, which was also noticed in Bhimaram.

21. Besides the surveys made by Mr. Thompson in the bamboo forests, a number of plots 50 × 50 yards were carefully examined, and all teak trees counted, by Captain Jarrett in 1868. The result is exhibited in the following statement:—

General position of Plots surveyed.	Number of surveys executed.	Average result per acre. 1st Class.	2nd Class.	3rd Class.	Saplings.	Estimated areas of these so-called North and South portions.	Number of Teak Trees. 1st Class.	2nd Class.	3rd Class.	Saplings.	Remarks.
North — Northern extremity.	7	1·45	11·60	19·36	29·00	4,239 acres ...	6,148	57,452	65,645	...	In 2nd survey, the saplings are amongst closely packed clumps of bamboos.
North — Between Monghyr and Mirkullu villages through the centre.	13	1·45	15·48	11·60	30·93						
Average of above ...		1·45	13·54	15·48	29·96						
South — Between Mirkullu and Tilwara villages, on the west side in a southerly direction.	Not stated	3·86	15·48	9·68	...	4,239 acres ...	16,366	65,645	41,043	...	
Total ...	...	...	...	...	...	13 sq. miles 159 acres = 8,479 acres	22,514	123,097	106,688	...	

It will be noticed that in the 20 plots surveyed in the northern portion, the number of first-class trees was found to be 1·45 trees per acre, while in the southern portion, near the western edge, the result was nearly four first-class teak trees per acre.

22. An enumeration of the teak and blackwood trees of all classes was made in 1870 by Captain Fox, with the following results :—

Number.	Total number of Sub-Divisions.	Total area, in acres.	Total number of Teak trees by classes.					Total unsound Teak of all classes.	Total number of Sissoo trees by classes.					Total unsound Sissoo of all classes.	Remarks.
			1.	2.	3.	4.	Total.		1.	2.	3.	4.	Total.		
1	3	306	210	431	930	827	2,401	756	58	107	300	194	659	233	Rs. As. P.
2	10	1,255	2,226	3,114	5,579	4,283	15,202	3,011	607	898	2,103	2,013	5,621	1,062	Cost of the tree counting operations, including all
3	30	3,707	6,880	8,768	14,522	11,243	41,413	7,834	946	1,570	4,120	3,774	10,410	686	charges ... 972 12 4
4	17	2,072	3,917	4,716	6,928	4,686	20,247	4,607	472	746	1,814	1,604	4,636	323	Cost per acre 0 1 10
5	12	1,139	2,499	2,464	3,462	2,214	10,639	3,095	200	373	1,019	765	2,357	89	Cost per tree (sound) ... 0 0 1
Total... 5	72	8,479	15,732	19,496	31,421	23,253	89,902	19,303	2,283	3,694	9,356	8,350	23,683	2,384	

The result of these surveys, viz., 15,732 sound first-class teak trees, on an area of 8,479 acres, is not borne out by any of the later surveys, and is doubtless far in excess of the actual number standing in the forest.

Blocks.

23. Before stating what has been done in the matter of fire conservancy, it will now be necessary to state the present division of these forests into blocks. This division is regarded as provisional, but upon the whole the blocks are well selected and will be found convenient for the purpose of this Report. Bhimaram is divided into 5 blocks, 3 of which, I, II, and V, comprise the southern portion, while III and IV constitute the northern part. The whole forest is divided by a line running north and south through the middle of the northern part, which divides the latter into two nearly equal parts, III and IV. In the southern half this line follows the main ridge to the highest point, whence it follows a valley to the southern corner. The hills and slopes east of this line, which are mostly steep and rocky, constitute block V, while the country to the west of this line is subdivided by a branch ridge into two blocks, of which I is the southern and II the northern block.

Mirkullu is divided into 5 blocks, A. being the outlying Mungair block, B. comprises the forests north of the main road already mentioned, C. is the next, extending south to the road from Tilwara to Mirkullu, D. extends south of this to the road from the old village of Motukneel to the village of Suggunghatta in the east, E. being the southernmost block of this reserve.

Compartments.

24. When the enumeration of trees was made in these reserves, these blocks were sub-divided into a number of compartments, of which 60 were in Bhimaram and 72 in Mirkullu. The sub-division lines between these compartments have not, however, been cleared and have not been kept up, and will not be required in future.

Protection against Fire.

25. The first successful attempt at fire conservancy was made in 1873, when blocks III and IV of Bhimaram were protected until the rains of that year; these blocks have since then been protected continuously and thus, at the time of my visit, had been protected for four consecutive years. Blocks I, II, and V were protected during the hot seasons of 1875 and 1876. In Mirkullu, blocks A., B., and C. have been protected during the hot season of 1876, and it is intended to protect blocks D. and E. during the impending season.*

The effect of protection is, as usually is the case, most marked in the case of tree forests without bamboos, though in the bamboo forests also the larger number of seedlings gave satisfactory evidence of the great improvement that had been effected. It is most instructive to notice the effect of fire conservancy in the blocks which have been protected for different periods. In block C. of Mirkullu, which had the benefit of only one season's absence from fires, the ground under the trees is still chiefly occupied by tall grass; while in blocks III and IV of Bhimaram scarcely any grass is left, the place of which has been taken by dense masses of seedlings and saplings, as previously described.

26. As regards the future treatment of these forests, the chief condition of satisfactory results is of course the continuance of fire protection. The risk from fire commences about the beginning of March and continues till the rains fall in the middle of June. Early in

* The whole of the forests have been protected since June 1876.—W. S.

March large troops of Banjaras, with their herds, settle in the country, surrounding the forests, and then the fires commence, which continue regularly until the end of the month, when most of the inflammable matter on the ground in the vicinity of the forests has been consumed. High westerly winds continue during the whole of March, and bursts of wind from the same direction are common in April. One chief source of danger is said to be the wind which comes up from the south, and the fires which spread northwards between the two reserves. Hereafter it may be found necessary to obtain control over this intervening belt,* which in places is one mile wide and nowhere more than 2½ miles, in order to facilitate the continued protection of the whole area.

No Banjaras and no cattle whatsoever are allowed to enter the reserve, and this prohibition must of course be continued; for the protection of these forests will always remain a difficult task, and the damage which would be done if fire entered any of the protected portions would be quite incalculable.

In so far, fire protection is easier than it was formerly, as the grass has diminished: a fire now entering the forest would travel more slowly, but it would do a great deal more damage to the forest than formerly before protection had commenced. We hope that no fire will enter these reserves, but, should this unfortunately be the case, the damage done to the young growth and poles of teak by the burning of the vast thickets of Saj, *Eriolæna*, *Helicteres*, Ghoraru, and the creepers, of which *Butea superba*, *Dalbergia volubilis*, and *Millettia* are the principal, will be much heavier than the damage which would have been done by the burning of grass. The present organization of fire protection is excellent; the forty-foot lines which surround the forest are cleared and burnt in January, and, in addition, on a width of 60 feet on the outside the grass is crushed down and burnt. As an additional protection, the centre line, which is 15 feet wide, is kept clear, as well as the lines which separate blocks III and II, and IV and V. In Bhimaram, three roads are used for traffic, which we will designate as the northern, middle, and southern roads; but no traffic is allowed on them after the first of March in the hot season. Through Mirkullu only the main road to Bamraghar is open all the year round, and is cleared for 20 feet on either side.

Future treatment.—Roads.

27. As regards the treatment of the forests, it will be convenient to discuss first what I propose should be done in the level or northern portion of Bhimaram, viz., comprising blocks III and IV. In order to regulate the working of the forests, and further to facilitate its protection from fire, I consider that it will be desirable, if not necessary, to increase the number of sub-divisional lines, and it seems to me that the best plan will be to lay two lines through this part of the forest, converging at the Alapilly depôt: their direction would, to some extent, correspond to the northern and central road, but they would be straight lines as far as the configuration of the ground will permit. The northern line would enter the reserve near pillar 22, and would run between the Sherpilli and Tilwara Nalas. The centre road would enter the reserve at a point further south, and would run between the Sherpilli and Tigul Nalas, and before leaving the reserve would cross the head-waters of the Sherpilli Nala. A third line may, perhaps, be laid through this part of the reserve, following the road from Kursani to Tilwara.

These three lines cannot be parallel, but that is of no great importance. What is important is that they should be straight for as long distances as possible, for the advantage of long straight clear lines in the matter of fire protection on level or gently undulating ground is incalculable. The advantages of straight over broken lines in this respect will doubtless ere long be discovered as the protection of the Tilwara block continues, and it will probably be found advantageous to cut off some of the numerous angles which the demarcation has given to this forest, in order to obtain greater length of straight fire lines. The width of the secondary lines which I propose for Bhimaram need not, in my opinion, be greater than 15 or 20 feet. They must of course be so laid as to serve as main lines for the export of timber from this forest, and, if we are successful in this respect, the timber traffic alone will keep them clear and obviate any expense on their maintenance.

28. The chief principle which I wish to express in this respect is that the sub-division lines of this forest should at the same time be the main lines for the export of its produce, and should be so constructed as to serve as further aid to fire protection. I am aware that an objection may be raised against this view of the case, and that it may be said that in future the three Nalas mentioned—the Tilwara, Sherpilli, and Tigul Nalas—will be used for the floating of timber, and that the main cart roads here suggested will fall into disuse. I have seen much of timber floating in the small streams of the Pegu Yoma, where floating is a necessary evil because the ground is too hilly to permit the construction of roads, and the forest too poor in marketable trees to pay for large engineering works to one point, but I have also had many years' experience of the utterly unsatisfactory nature of these operations; the timber is dragged to the side, or put into the stream, and large gangs of men with elephants have to wait week after week during the monsoon for a favourable flood, which frequently only occurs once or twice during the season, and often fails altogether;

* The intervening block has just been bought.—W.

and these streams in the Pegu Yoma of which I speak drain vast areas of hilly country, with a rain-fall between 70 and 100 inches, while the three streams here mentioned are utterly insignificant; they drain a small area of low hills, have shallow tortuous beds, and will never, I am certain, be used with advantage for the export of timber produced in the Bhimaram Forest.

My proposals, therefore, are based upon what I consider the safe assumption that the timber from the northern part of Bhimaram will all be brought out in carts. Timber has been floated down to Alapilly by the Tilwara and Sherpilli Nalás, but with considerable difficulties, and I feel assured that if roads are constructed, as here suggested, these will in future be found the cheapest lines of export.

We may also safely assume that the depôt whence the timber will be taken to the main river will always remain at or near Alapilly, as from this point the timber is floated down the Alapilly Nala throughout the monsoon. Logs can only be floated when the nala is in flood, which happens several times in the season, and scantlings can be floated a considerable time after each flood.

If these roads are made, the distance from Alapilly to the eastern limit of the reserve will be 3 miles by the northern and 4½ miles by the centre road, and both lines, if continued eastward, will serve as export lines from the Mirkullu Reserve. The cutting of these lines, and the making of fair weather roads along them, is the first work in this respect which I propose for this part of Bhimaram. But as the principles here enunciated may not be immediately recognized, I propose that, in the first instance, only the northern line be taken in hand. After this has been completed, I suggest that that portion of Bhimaram which is between it and the northern boundary be taken in hand, and that thinning and cutting be commenced in it, in accordance with the following remarks.

29. This part of the forest consists chiefly of that type which we have designated as the Teak Forest type, with a belt of moist shady forest along the Tilwara Nala. Instead of attempting to lay down definite instructions for the treatment of this block, it will be preferable to explain the general principles which should guide the treatment of the three great forest-types which, as already explained, are found in the northern parts of Bhimaram. In making these remarks, it should be clearly understood that these three types are nowhere sharply separated, but that they insensibly pass one into the other, and that therefore the general principles which are here explained must be applied with an intelligent regard to the constitution of each part of the forest.

It is hoped that eventually it will be possible to find a sale for the large quantities of Saj, Kaim, and other timbers produced in this forest, but at present we are only justified in regarding teak, blackwood, and bijasal as certain to find a market at remunerative rates. Our object, therefore, must be by all means to increase the production of these three species, and, considering the great luxuriance with which teak grows in this forest, the effect of our endeavours, if well directed, will undoubtedly be to increase the proportion of teak in this forest.

30. The establishment of the saw-mills at Alapilly, which was effected under great difficulties in 1872, and the admirable and efficient manner in which the cutting up of the timber and its floating up stream to Warora and Kamthi has been effected, give good ground for hoping that a sufficient market at remunerative rates will be found for all the teak timber which these mills can cut up. The out-turn of the mills has been as follows during the last five years:— Alapilly Saw-Mills.

Description.	Out-turn of 1872-73.		Out-turn of 1873-74.		Out-turn of 1874-75.		Out-turn of 1875-76.		Out-turn of 1876 to 31st December 1876.		Total.	
	No.	C. ft.	No.	C. ft.	No.	C. ft.	No.	C. ft.	No.	C. ft.	No.	C. ft.
Sleepers ...	10,807	33,761 0 0	7,491	23,401 11 0	20,994	62,748 2 6	18,771	58,640 7 3	2,709	9,168 11 11	60,772	187,720 8 8
Beams sawn on all four sides ...	38	960 9 0	722	8,304 8 3	...	...	40	1,273 6 0	44	1,505 10 5	844	12,049 9 8
Scantlings ...	933	993 0 0	6,178	14,044 5 5	10,049	9,531 7 2	2,781	4,048 4 0	5,761	5,729 0 8	25,722	34,346 5 3
Planks ...	51	96 7 0	2,463	4,310 0 0	...	...	2,096	3,954 8 2	1,493	2,724 5 5	6,103	11,085 8 7
Total ...	11,829	35,811 4 0	16,854	50,061 0 8	31,043	72,279 9 8	23,688	67,922 1 5	10,027	19,128 4 5	93,441	245,202 8 2

Besides the above, the following timber has been turned out:—

Battens	6,029=46,379	running feet.
Rafters	640=5,458	ditto
Railway keys	1,316	

Of this timber, 2,746 sleepers and 15,149 scantlings were the produce of timber obtained from the Zamindar. The rest was all the produce of the reserves, viz.—the 2,432 trees already mentioned, timber already collected at depôts, and dead timber collected from all parts of the forest.

Stock of Timber.

31. In blocks III and IV, we have come to the conclusion that it would not be wise to limit cuttings to teak of the first class, 24 inches in diameter and upwards, for by far the larger proportion of second class trees from 18 inches and upwards in diameter are old or unsound, and as a rule we cannot expect them to improve considerably either in size or condition. To the same conclusion we have come with regard to the Hill Division and Mirkullu. The following statement shews the number of sound and unsound trees of the several classes counted in Mr. Thompson's surveys, and it will be seen that in all classes the latter exceed the former. The large excess of unsound trees of all classes in Mirkullu is justly ascribed to the former prevalence of Dhya cultivation in that forest:—

Reserve.	Class I.		Class II.		Class III.		Class IV.	
	Sound.	Unsound.	Sound.	Unsound.	Sound.	Unsound.	Sound.	Unsound.
Bhimaram Plain	93	95	55	79	65	181	219	246
„ Hill	49	171	65	149	148	226	134	279
Mirkullu	16	104	52	135	209	399	226	391

Accepting this conclusion, we have the following quantity of timber at present available, including all first and second class trees, whether sound or unsound:—

	I & II Classes.	III & IV Classes.
Bhimaram, Plain portion	26,500	59,800
Ditto Hill ditto	48,000	92,000
Mirkullu	30,000	123,000
Total ...	104,500	274,800

These figures are based upon Mr. Thompson's surveys, which seem to us likely to yield the most reliable data; for, as explained above, the results of the enumerations made at different times cannot be depended upon.

Annual Yield.

32. The question now is—over how many years ought we to spread the cutting out of the first and second class trees, so as to secure a continuous supply after that period? The above statement shews that the trees of the third and fourth classes are more than twice the number of those of the two first classes, but, from the figures in the above tabular statement, it is clear that more than one-half of the smaller trees also are unsound, and that therefore a portion of these only can be depended upon to regenerate the forest.

The saplings and seedlings in the fire-protected portions are fortunately numerous, and all our operations must be directed towards increasing their numbers.

33. What we know at present of the rate of growth of the teak produced in these forests indicates a very slow rate of growth, not less than 20 rings per inch of radius. If we had no reason to expect a better rate of growth, the largest fourth class tree with a diameter of six inches would require 180 years until it had attained a diameter of 24 inches. But it is out of the question to spread the cutting of the first and second class trees over such a period nor is this necessary for two reasons:—

First.—The slow rate of growth at present observed in Ahiri timber is the result of annual jungle fires, which impoverish the soil and check growth. Under continued fire protection we may hope for better results, and it is not too much to expect that the present young growth of the forest will lay on wood at a much faster rate. If the result of our protective measures were a growth at the rate of eight rings per inch, a fourth-class tree now six inches in diameter would attain first-class size in 72 years, and it does not appear unreasonable to expect such a rate of growth, which is considerably less than has been attained in the Nilambur plantations in Malabar.

Second.—There is no necessity to arrange for the continuous yield at the same figure where the management of a forest of so limited an area is concerned; and in the present case, with the large quantity of unsound timber in the forest, it is obviously much better to provide for an interrupted yield than to delay the regeneration of the forest, and to risk the great mass of the present first and second-class trees becoming worthless before they are cut

Under these circumstances, we have come to the conclusion that the best plan will be to fix the maximum of these two classes of trees to be cut annually at 2,500, which will, if the estimate of the present stock is correct, make it last for about forty years.

System of Cutting.

34. There is no doubt that the northern part of the Bhimaram Forest is the first that requires cutting in order to accelerate its regeneration. The task therefore in this forest is how to arrange the fellings contemplated with due regard to the maintenance of the forest as a good teak-producing tract. If we were to cut out gradually all first and second class teak trees on the same principles on which the 2,432 trees were cut between 1872 and 1874, the result would be that the blanks thus created would be taken up by forest of other kinds; for although teak is more numerous in this part of the forest than any of the other trees taken by themselves, yet it is apparent, from the survey of 34 acres discussed above, that it is in the proportion of one to nine. Young teak, it is true, has the great advantage of forming powerful terminal shoots, and it thus happens that a comparatively small number of teak saplings hold their own in large masses of young growth of other kinds; and in this forest particularly, the last year's terminal shoots of teak are extremely vigorous and in places from 4 to 5 feet long; nevertheless it must not be forgotten that rapidly-grown teak has many enemies, and that caterpillars or other insects may destroy large numbers of teak saplings. If all teak trees of the two first classes were cut out, and all trees of Saj, Kaim, and other kinds were left standing, the young growth under the shade and in the vicinity of these trees would certainly not be teak, but would consist of other kinds which stand shade better than teak. It would doubtless not be desirable to convert this forest into a pure teak forest, but there is not the least risk of such a thing; on the contrary, the risk is that, unless carefully managed, the trees of other kinds will get the preponderance. Under these circumstances, it is my opinion that, simultaneously with the cutting of all first and second class teak trees, a corresponding proportion of the trees of other kinds must be cut, or, where they cannot be utilised, killed by barking or girdling. The operation therefore will consist of two portions:—the cutting of the greater number of first and second class teak trees, and the cutting out or girdling of trees of other species. This part of the business will undoubtedly be beset with considerable difficulties; eventually we may hope that a proportion of the Saj and Kaim may be exported without loss, but at present we have no ground to hope for a sale of all the timber of other kinds, which must be removed simultaneously with the teak if the forest shall not deteriorate. Perhaps it will be best to commence the thinning out of the less valuable species by the removal of young growth and the cutting of creepers. The last-named operation will be most beneficial, for a large proportion of the young growth which has come up in this forest consists, as already mentioned, of *Butea frondosa*, *Millettia*, and *Dalbergia volubilis*. Simultaneously with the cutting of creepers, it may be possible greatly to improve the prospects of the young teak by cutting out saplings, or small trees of other kinds which interfere with its development. These operations are easy, because they do not entail the removal of masses of timber, and as soon as this part of the forest has been divided into permanent compartments, this operation should be taken in hand and continued until completion.

35. Much more difficult is the removal of the larger trees of other kinds. A glance at the statement in paragraph 9 will show that, in the 34 acres adverted to, out of 13 first and second class trees there were only 4 teak trees; if we therefore undertake the removal of a corresponding number of other kinds, it will be necessary, for every teak tree, to cut or kill at least two others. It has been said above that there is no risk whatsoever of our unduly increasing the proportion of teak by such an operation; for if we look at the third and fourth class trees recorded in that statement, we shall see that, of a total number of 77 trees per acre of these two smaller classes, teak only numbers 7. It is out of the question to attempt the removal of the smaller classes, and we must be satisfied with dealing with the larger trees. Saj and other trees with distinct heartwood may readily be killed by girdling, and, provided a girdled tree does not fall and does not multiply insects, not much harm will be done by this operation. But I am of opinion that it would not be wise to kill large trees by girdling over a large area of this forest, without having acquired some experience as to the effect which it will have upon the forest. Kaim, Haldu, Palas, and other trees cannot be killed by girdling at once: they continue to live for some time and die gradually.

My suggestion, under these circumstances, is to complete the operation here indicated in two compartments of the forest under discussion, cutting at the same time the yield of two years, and then to leave the compartments so treated for at least five years, in order to watch its effect before extending it over the whole forest.

36. As already said, the destruction of creepers, and the giving room to teak by cutting out smaller trees interfering with it, should be continued throughout this whole portion of the forest. The remarks here made apply chiefly to that type of forest which we have designated as the teak forest. In the moist or shady forest I do not advocate any cuttings at present. To undertake to cut out trees of the other kinds would be utopian, and to cut out the small proportion of large teak trees found in it would have the effect of altering the character of this type of forest for the worse. These irregularly-shaped belts of moist forest must, in my opinion, remain as they are, except that creepers should be destroyed as in the rest of the forest, and that, when opportunity offers, the growth of teak should be furthered.

In the third type—the open forest on dry ridges—I do not advocate any cutting at present, except of creepers and of small trees which interfere with the growth of teak.

37. A few words should now be said regarding the sub-division of blocks III and IV into compartments. It will probably be found convenient to maintain the centre line already cleared, but, wherever practicable, it should be straightened. The two blocks, the treatment of which is here discussed, would thus be divided into six new blocks by the centre line and the two new lines proposed to be cut. The two northern blocks would probably not require sub-division, but the four others should gradually be sub-divided into compartments, the ruling principle in the selection of these sub-division lines being entirely facilities for the export of timber. No sub-division line should be cut which cannot be used for this purpose; it is out of the question to sub-divide this portion of the forest according to the character of its forest growth.

If these suggestions are accepted, and if a system of compartments in the manner here indicated is adopted, it will be easy to regulate the operations suggested in a satisfactory manner. They would be regulated both by the quantity of teak felled and by the area; and I would suggest that in the first year the yield of two years be cut in compartments situated in different parts of the forest, say one in the north and one in the centre, and that then, as already mentioned, five years should be allowed to intervene before similar operations are undertaken in the same part of the forest.

38. I wish particularly to guard against the impression that I consider it necessary to cut out the maximum number of teak trees annually. On the contrary, I believe that it will be well not to work up to the maximum, because in many cases it will be an advantage to allow groups of promising young trees, although they are above 4′ 6″ in girth, to stand. Such trees should not be allowed to stand singly, for storms do a considerable amount of damage in this forest; and where second or even first class trees are allowed to remain standing, a corresponding number of trees of other kinds should also be left.

39. It may be thought that, instead of carrying out this operation by compartments, it would be preferable to distribute each year's cuttings over the whole forest, and to carry on these operations by means of continued selection cuttings. I do not think this would lead to a satisfactory result. It would be out of the question to form any opinion regarding the effects of these operations, unless each year's work was concentrated on a limited and well-defined area. Moreover, the circumstance that many of the girdled Saj and other trees would fall, and thus encumber the forest, would make it difficult to come back several times to the same locality in order to complete work in it.

Even the simple and easy operation of cutting creepers and small trees, which impede the growth of small teak in this part of the forest, cannot efficiently be effected and controlled unless a defined and clearly limited area is taken in hand every year, and even this operation will be greatly facilitated by the formation of permanent compartments. But, as already explained, what I immediately urge, as a necessary measure not only to facilitate these operations, but also for fire conservancy, is the cutting of the two main lines here described, which, for convenience sake, we will call the northern one the Bhumbara and the next the Sherpilli line.*

40. The treatment of blocks I, II, and V, which comprise the hilly portion of Bhimaram, must be regulated in a different manner. As already stated, our knowledge of the growing stock in these blocks is based upon the enumerations effected by Captain Jarrett's, Mr. Hicks', and Mr. Thompson's surveys, the results of which, placed side by side, stand as follow:—

	Class.			
	I.	II.	III.	IV.
Captain Jarrett, sound trees only	34,388	32,657	58,395	44,405
Mr. Hicks, ditto ditto	7,582	12,897	19,132	13,463
Mr. Thompson, all trees	23,280	24,909	43,533	48,306

If Mr. Thompson's figures are accepted, we may gradually cut out from these blocks, during the next forty years, upwards of 48,000 first and second class trees. This however is only a very rough provisional estimate and is based upon the survey of 50 acres in a total area of 5,820 acres, and a larger proportion of these linear surveys was made in the valleys on the west side than in the hills themselves. As far as the treatment is concerned, the level and undulating ground in the valleys, which is chiefly stocked with tree forest without bamboos, must be considered separately from the bamboo forests in the hills; and in this bamboo forest

* These two lines have since been cut.—W. S.

again, there are large patches without bamboos and stocked with tree forest which will require separate treatment. In all cases, however, the guiding principle must be to increase the young growth of teak. But before attempting any work in this direction, these blocks must first be sub-divided.

41. Block V, consisting chiefly of rocky slopes, must, certainly for many years to come, be left almost entirely alone. From the more gentle slopes at the northern end of this block, and from some places in the vicinity of the boundary line, it may be advisable to extract timber, but these will be isolated operations, and there seems no necessity at present for attempting a division of this block into compartments. The same remark applies to the Bhimaram spur, where, I understand, the ground is exceedingly rocky and broken. There remain, therefore, for extraction of timber and improvement on a large scale, only the two bays or valleys of the Pataknil and Bhimaram Nadis. These valleys are separated by a spur down which a sub-division line was cleared in 1869. This line is natural, and should be maintained. Each of these two bays should, however, be sub-divided into two compartments, and this will most conveniently be done by making two export roads up these valleys to a convenient point at the foot of the hills. These roads cannot of course be straight on account of the broken nature of the ground, nor will they separate the two valleys mentioned into equal portions; but this does not matter; main export lines up the valleys are necessary, and they will serve all the requirements of rational management at present. The question where these roads should join, and what line they should follow to the Alapilly depôt, should of course be carefully considered.

If these suggestions are accepted, the three blocks I, II, and V will be formed into six new blocks as follows :—

Old Blocks.		New Blocks.
I	1.	Bhimaram Valley, North.
	2.	Ditto ditto, South.
	3.	Ditto ridge.
II	4.	Pataknil' Valley, North.
	5.	Ditto ditto, South.
V	6.	Mamil Block.

The chief work will be in new blocks 1 to 4, and it is quite obvious that these blocks cannot furnish the whole 48,000 trees estimated to stand in South Bhimaram. The treatment of that portion of these blocks which is situated in the valleys and near the boundary must be regulated by the experience gained in North Bhimaram, but the slopes of the hills which are clothed with bamboo will require a different treatment.

42. At present there is not much prospect of exporting bamboos from this forest, and, unless it is found to pay to export crushed bamboo fibre for paper manufacture, the only hope of regenerating the teak on a large scale is in the flowering and seeding of the bamboo. Our experience in the Bori Forest has shewn that, on favourable soil and under fire protection, tree forest, and particularly teak, takes up every blank formed by the seeding of a bamboo clump, and there is no reason why the same improvement should not take place here. Circumstances in this respect are extremely favourable, the slopes at the back of the two bays mentioned are almost exclusively clothed with teak and bamboo, so much so that a considerable proportion of the older teak trees may with advantage be cut out, without risking the regeneration of the forest in a satisfactory manner, and in this bamboo forest it will hardly be necessary to cut out any of the other trees. The statement given in paragraph 16 shews that of 38 trees counted per acre, 24 were teak. It is true that in this counting only six kinds were counted, but the others are so scarce in the bamboo forest that they may be neglected. The figures of the following statement exhibit the constitution of the bamboo forest examined on 10 acres at the head of the Bhimaram valley :—

Species.	I Class.	II Class.	III Class.	IV Class.	Total.
1. Teak, per acre	7·1	5·1	8·1	6·8	27·1
2. Sissoo, „	0·1	0·2	1·2	2·3	3·8
3. Saj, „	...	0·1	...	0·4	0·5
4. Kaim, „	0·3	...	0·3	1·0	1·6
5. Kosum, „	0·0	0·1	0·0	0·1	0·2
6. Haldu, „	0·0	0·1	0·1	0·4	0·6
7. Bija, „	0·0	0·1	0·3	0·2	0·6
8. Bamboo, „	...	...	...	...	58·4
				Total per acre ...	92·8
			Number of Teak seedlings and saplings		29·5 per acre.

It is obvious that a considerable proportion of the 12 first and second class teak trees found to stand per acre may be cut out, and that there will still be seed enough to produce young growth of teak in the event of any of the 58 bamboo clumps per acre seeding. Besides the seed produced on the ground, there will, on all lower slopes, be a large quantity of seed washed down from the ridge. For the same reason, on the numerous plots in dells and on the tops of ridges where bamboo is wanting, a proportion of the teak trees of the two first classes may be cut out, with great benefit to the first.

43. These remarks will explain that the treatment of these bamboo forests in the immediate future will be a much more simple procedure than the treatment of the North Bhimaram blocks. Under these circumstances, I suggest that, after two or three years' yield has been taken out from North Bhimaram, we should suspend operations, except of course the cutting of creepers and small trees, as previously explained, and should then provide for the necessary timber yield by cutting in the bamboo forests at the head of the Pataknil and Bhimaram Valleys.

44. It will be desirable, under all circumstances during the next ten years, to supplement the timber taken out from the reserves by purchasing from other forests in the zamindari. We have explained above that to keep the mills fully employed it will be necessary to cut up 4,000* trees per annum; although the maximum yield of the reserves has been fixed at 2,500 trees during the next forty years, it is most desirable that we should keep considerably below this yield, and this is particularly necessary during the next ten years, while our operations must of necessity be of an experimental character.

If the order of operations here suggested be accepted, we may be able, after the first two or three years, to suspend cuttings in North Bhimaram for a sufficient period to gain experience, in order to modify the plan of operations for this part of the forest as circumstances may require. Again, the fellings in the bamboo forest, though extremely plain and simple, will doubtless be found to be susceptible of improvement, and the arrangement here suggested will enable us to watch the result of the operations here while continuing work in North Bhimaram.

Mirkullu.

45. Regarding the treatment of Mirkullu, it will suffice to say that the bamboo forest in this reserve may probably be subjected to a treatment similar to that proposed for South Bhimaram, while operations in the western, more level, portion had better be delayed until sufficient experience has been gained regarding the treatment of similar forest in North Bhimaram.

The following statement exhibits the constitution of 34 acres examined in the bamboo forest in the centre of that reserve :—

Species.	I Class.	II Class.	III Class.	IV Class.	Total per average acre.
Teak	1·9	2·2	7·0	7·2	18·3
Saj	1·0	1·0	1·6	1·8	5·4
Kaim	0·3	0·2	0·9	1·9	3·3
Sissoo	0·1	...	0·6	3·0	3·7
Bija	...	0·1	...	...	0·1
Kosum	...	0·1	...	0·4	0·5
Haldu	...	...	...	0·1	0·1
Bamboo	...	...	...	...	75·0
				Total ...	106·4
			Teak saplings and seedlings ...		3,175 or 93 per acre.

It will be noticed that the bamboos are much thicker—75 clumps per acre, as against 58 on the Bhimaram Hills. On several acres the number of clumps per acre exceeded 100—viz., 107, 114, 116, 117, 125, 131, 137, and 165.

The number of teak trees is considerably less than in Bhimaram, particularly of the larger sizes, the aggregate number of first and second class trees being only 4 against 12 in Bhimaram. This is readily explained by the circumstance already noted, that a large portion of this forest has been cut and burnt for Dhya cultivation to a much greater extent and at a later date than the hills of Bhimaram.

It is further remarkable that Saj, which is almost wanting on the Bhimaram Hills, is here found in considerable numbers; this circumstance is explained by the difference of soil and less steep slopes. In the forest of this description which occupies a large area on the eastern boundary of Mirkullu, very few teak trees only can be cut, unless a considerable demand for

* Of late years considerable quantities of Saj have been cut up into sleepers.—W. S.

bamboos arises. It does not seem improbable that over a large portion of this area the bamboo may flower simultaneously, and in that case it will probably be necessary to plant.

46. Everything seems to tend to the conclusion that operations in Mirkullu should be delayed until more experience has been gained in the treatment of the forest in Bhimaram. It is impossible now to say what proportion of the 30,000 trees of the first two classes which it is supposed may be felled in this reserve will actually be available. So much however is certain that, if in the present state of our experience we commence timber operations in Mirkullu, we should not be justified in cutting more than a very small proportion of this number. The bamboos in this reserve are, as already stated, of unusually fine growth, and we must hope that, when the time comes for taking Mirkullu in hand, we shall be able to facilitate our operations by the export of these bamboos either entire, or crushed for the manufacture of paper.

Under these circumstances, it would be premature to propose any sub-division of the forest into blocks and compartments beyond that now existing—the three sub-division lines which run through the reserve from west to east. The northernmost, as already stated, is a main road, which should be kept clear, and the two others should, in my opinion, be likewise kept clear permanently.

47. One of the points which have struck me forcibly in examining these forests, and the documents regarding them, is the necessity of arrangements to make it easy for a new Officer joining the division to obtain all the information required for his work. The present Divisional Officer possesses a most intimate knowledge of all parts of the forest, of the disused roads and pathways, and other localities of note; but in a forest which is protected from fire, and which is practically closed during the hot season, as the Ahiri Forests must be, roads and paths disappear in a short time; and though the Conservator himself is intimately acquainted with the forests, and there are one or two among the subordinate Officers who have some knowledge of it, yet any change in the *personnel* will necessarily be a source of considerable difficulty and much loss of valuable time before the new men have acquired the needful local knowledge. This is particularly necessary in the present case, as the villages in the vicinity of the Ahiri Forests not rarely change their position, and some of them of late years have become deserted. But it is necessary that in every forest protected from fire a system of sub-division lines should be maintained and cleared every year, and that the more important of the existing paths and roads should be kept open. The inspection of the different parts of a fire-protected forest by Officers of all grades must be made as easy as possible, and this can only be effected by keeping certain lines open. Record of Work.

As regards Bhimaram, the needful suggestions have been made above, and if the centre line, together with the three main lines which run from west to east, and the lines by which it is intended to sub-divide old blocks I and II in the hilly portion are kept clear, the inspection, as well as the protection from fire, will be greatly facilitated, and every additional line cut in order to sub-divide blocks into compartments will improve matters. It has already been explained that, as a rule, no sub-division lines should be made, except those which can be used for the export of timber. A praiseworthy attempt has lately been made by one of the subordinates to facilitate the inspection of the forest and to fix the name of localities by putting up sign posts; but the main points are that sub-division lines should be kept clear, that all new lines added be entered on the map, and that suitable local names be given to them.

These remarks chiefly relate to Bhimaram, where for a number of years the chief work must be concentrated. In Mirkullu the work of sub-division must be taken in hand when the time for working this forest has arrived.

48. I also suggest that copies of the detailed maps prepared by Mr. Brereton be made, so as to guard against loss.

Many other documents relating to these forests have been mentioned in this Report, such as the record of the enumerations of the growing stock made at different times, and of the valuation surveys lately executed. I would urge that the chief of these documents be copied in the books and registers, which must be maintained as a perpetual record of all that concerns these important forests.

49. It remains now to say a few words regarding the measures that must be taken to prepare the way for a regular plan of operations. Foremost stands, in this respect, the maintenance of a detailed record of every operation undertaken in these forests; this will find its appropriate place in the Journal of the Reserve, which should be written up at least once a month.

Hardly of less importance is a more complete system of valuation surveys, made in accordance with the plan so successfully adopted by Mr. Thompson. Here again I beg to urge, in the strongest terms, the advantage of making these surveys separately for each compartment.

The course suggested for the operations will probably not make it necessary at once to form more than a limited number of compartments in a few blocks of the Bhimaram Reserve; but wherever compartments have been formed, lines of valuation surveys should be laid through them, in such a manner as to give fair samples of the constitution of the forest in

the compartments. I also suggest that, in recording these valuation surveys, the commencement of a new forest type be always noted, so as to make it possible to maintain a distinct record of surveys made in forest of different types. It need not be explained that these surveys should precede the felling operations here suggested. The record kept of these operations as they are completed in each compartment will then afford a good check of the surveys, and will enable us to form a conclusion regarding the percentage of area which should be surveyed in order to obtain an approximate statement of the growing stock in the forest. No surveys should be made in these forests, in my opinion, in which all trees of the four classes, as well as bamboos, are not counted, for the object of these valuation surveys is to give a complete account of the growing stock above a certain age.

Establishment.

50. The permanent establishment at present entertained consists of a Forester on Rs. 40 per mensem, and 6 Forest Guards at rates of pay from Rs. 8 to Rs. 10 per mensem; besides these the temporary establishment for fire protection consists of 3 mates and 20 watchers for the Bhimaram Reserve, and 3 mates and 22 watchers for that of Mirkullu.

The total cost of fire protection during 1875-76 has been Rs. 2,574-8, and the estimate for 1876-77, including the entire area of the two reserves, is Rs. 2,659.

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